INVESTIGATION OF THE RELATIONSHIP OF BODY TEMPERATURE, SERUM ESTRADIOL, AND SERUM PROGESTERONE TO THE ONSET OF PARTURITION IN THE MARE

A Thesis

by

SOMMER CHRISTINE MORGAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2007

Major Subject: Animal Science

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Approved by:

Chair of Committee,	Martha M. Vogelsang
Committee Members,	Pete G. Gibbs
	Katrin Hinrichs
	Brett D. Scott
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ABSTRACT

Investigation of the Relationship of Body Temperature, Serum Estradiol,

and Serum Progesterone to the Onset of Parturition in the Mare.

(May 2007)

Sommer Christine Morgan, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Martha M. Vogelsang

In cattle and sheep, a significant decrease in temperature has been noted prior to parturition. In the mare, similar temperature decreases have been documented, although results have been inconsistent when temperatures were taken rectally. One study reported a significant temperature decrease when using data from a radio transmitter inserted into the mare's flank. The current study utilized nineteen Quarter Horse mares and one Thoroughbred mare, and was conducted from February to June 2006. Each mare had been previously implanted in the nuchal ligament with a microchip capable of reporting body temperatures. Blood collection and temperature recordings began 2 wk prior to each mare's expected foaling date. Once the mare was estimated to be within 48 h of parturition, temperature was recorded every 3 h until parturition using both the microchip and rectal thermometer. Progesterone and estradiol 17-β were evaluated from daily blood samples from -10 to ± 5 d relative to foaling for determination of the relationship between these steroids and body temperature, time of foaling, birth weight and sex of foal.

A significant decrease in rectal temperature ($P < 0.05$) was noted when the last temperature recorded was taken within 12h of parturition. Microchip data did not demonstrate any significant differences among readings before parturition. No significant difference was noted in the mean rectal temperature of all days relative to the sex of the neonate; however, microchip data showed mares carrying females to have a significantly ($P < 0.05$) higher mean rectal temperature of all days. Sex of the foal was not shown to be related to maternal concentrations of either progesterone or estradiol 17-β. A direct significant correlation between temperature and maternal plasma concentrations and progesterone and estradiol 17-β was found.

ACKNOWLEDGEMENTS

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I would especially like to thank Electronic ID, Inc. and Dr. Kevin Owen for the generous donation of the scanners and microchips that were utilized in this study.

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CHAPTER I

INTRODUCTION

Due to foaling complications, otherwise healthy mares and foals die during parturition every year. Predicting the time at which parturition will occur baffles horse owners, veterinarians and researchers alike due to the great variability in signs of parturition among individual mares. There are many changes that mares undergo prior to foaling; however, some changes occur more rapidly than others. Many mares present changes days before foaling and others just hours prior to foaling. Maiden mares can show fewer, more subtle signs of impending parturition than parous mares. Finding a reliable method to detect when a mare will foal could be beneficial in reducing losses of mares and foals. Often, if dystocia occurs, having someone present could possibly save both the mare and foal's life.

Studies in other species have shown that the body temperature of the dam could be a predictor for determination of the time, within hours, of the onset of parturition. Daily temperature recording would be an easy and inexpensive method of prediction for horse owners. Further, the use of an implanted microchip with the capability of measuring and displaying a horse's body temperature upon scanning could greatly improve the ease of collecting these temperatures. The utilization of biothermal microchips may also improve the reliability of temperature recordings by the potential elimination of human error.

This thesis follows the style and format of the Journal of Animal Science.

As a mare nears parturition, there are numerous changes in her endocrine status. Progesterone concentrations increase up to 4 wk before parturition, but within the last few days or even hours progesterone decreases. In contrast, estradiol concentrations may increase prepartum, although not significantly (Ginther, 1992). This relationship is different from that seen in most other mammals, in which progesterone falls and estrogen rises in the weeks before parturition. The actual role of these hormones in facilitating parturition in the mare is still unknown. It is also unknown whether the weight or sex of the neonate causes any effect on the temperature or the hormonal profile.

Progesterone concentrations are positively correlated to body temperature in many species and the fall of progesterone as parturition nears is correlated to a fall in rectal temperature (cattle - Lammoglia et al., 1997; cattle - Wrenn et al., 1958; rats - Nieburgs et al., 1946). When taken rectally, there is little evidence that a change in the mare's body temperature occurs prior to parturition (Cox, 1969; Ammons et al., 1989). However, a radio transmitter surgically placed into the flank of mares has been shown to be an effective method for temperature evaluation and has demonstrated a decrease ($P < 0.1$) in the mare's body temperature prior to foaling (Cross et al., 1992). Knowing that a change in body temperature has been observed, finding a more practical method of detection is warranted.

Microchips are now available for horses that will record and display body temperature and which require less invasive implantation than do radio transmitters. The utilization of an implanted microchip could increase the accuracy of recording body temperature when compared with rectal temperature, given its constant location in the nuchal ligament of a horse's neck and its ease of use for the typical horse owner. The rectal environment is primarily fecal matter and gas, which can insulate against changes in body temperature, thus possibly creating inaccurate temperature readings.

There is minimal research comparing this potential pre-partum change in temperature with a mare's hormonal status, the sex of the foal, and the weight of the foal at birth. Such a study is needed to determine if these parameters would be useful for predicting the time of parturition and minimizing mare and foal losses. The objectives of the current study were to determine whether use of a biothermal microchip implant for measuring temperature would be effective for predicting time of parturition, to compare temperature in the peri-parturient period with concentrations of progesterone and estradiol 17-β in maternal plasma, and to determine whether a relationship exists between the dam's body temperature and sex of the foal and weight of the foal at birth.

CHAPTER II

LITERATURE REVIEW

The trigger for the onset of parturition in the mare is still unknown. Many theories exist attempting to explain the events that may lead to parturition. In 1968, Cox investigated further the findings of Wright (1943) that the mare's body temperature demonstrated no change except during the first stage of labor, where it decreased. Cox (1968) used 4 pony mares and recorded rectal temperature 3 times daily. It was concluded that there was no rectal temperature change from normal that could be used to predict time of parturition. These findings were further corroborated by Ammons et al. (1989) who found no change in rectal temperature that was useful in predicting parturition. However, Shaw et al. (1988) studied rectal body temperature changes during the 2 wk prior to parturition in the mare. Results from averaging the two daily temperature recordings demonstrated a 0.1 ^{o}C decline ($P < 0.05$) the day prior to parturition, with a larger number of mares showing a decrease in the temperature recording collected in the evening. Haluska and Wilkins (1989) observed a distinct circadian variation in rectal temperatures in the mare showing temperatures to be higher in the evening. However, on the day prior to parturition, that circadian variation was not found. Additionally, they reported a decrease in the rectal temperature on the day of foaling. Haluska and Wilkins (1989) further reported an increase in temperature post-partum, which returned to normal within a day.

More recently, Cross et al. (1991) developed a radiotelemetric system that is capable of monitoring the mare's body temperature. The system that was developed involved a radio transmitter that was surgically introduced into the mare's flank. The data were collected onto a computer hard drive using a pair of closed loop antennae. Recordings were made every 5 min from -168 h pre-partum to 168 h post-partum (Cross et al., 1992). They found a decrease ($P < 0.1$) in body temperature, starting 4 hr prior to parturition, of 0.76°C. Unfortunately, the surgical invasiveness of this procedure could deter most mare owners.

Wrenn et al. (1958) explored body temperature variations in dairy cattle prior to parturition and found a decrease in vaginal temperature during the last 2 d of pregnancy. Ewbank (1963) found a pre-calving temperature decrease ranging from 0.2 -1.9°C. He also stated that if a cow's temperature is 38.9 °C or higher, they were unlikely to calve in the next 12 hr. In sheep, Ewbank (1969) reported a similar temperature drop, but was unable to determine a specific temperature or temperature change, as the individual sheep recordings were highly variable. In 1975, Winfield et al. discovered when a sheep's rectal temperature fell below 39.2°C for single-bearing ewes and 39.35°C for twin-bearing ewes; more than 80% were within 48 h of lambing. King et al. (1972) found no fall in rectal temperatures in swine preceding parturition, but did see increased body temperatures following farrowing. King et al. (1972) cited that Weisz found a decline in body temperature 2 d prior to parturition in swine, but they were unable to reproduce this drop.

Some studies have attempted to correlate temperature with progesterone concentrations. It has been reported in beef cattle that the body temperature and progesterone concentration are correlated and can be used to predict calving time within a 22 h period (Lammoglia et al., 1997). In other species, such as humans (Buxton and Atkinson 1948), rats (Nieburgs et al., 1946), and dogs (Concannon et al., 1977; Concannon and Hansel, 1977) increased progesterone concentrations are associated with an increase in temperature. Elmore and Garverick (1979) were unable to prove a correlation exists between progesterone and rectal temperatures in swine. In the mare, Ammons et al. (1989) were unable to correlate rectal temperature with progesterone concentrations. This association should be explored further in the mare to identify whether a temperature decrease occurs relative to the fall in progesterone immediately prior to parturition.

It is generally understood that by promoting myometrial quiescence, the presence of progesterone prevents parturition, whereas the presence of estrogens favor the onset of parturition due to actions on cervical relaxation, increased uterine contractions, increased prostaglandin synthesis and increased oxytocin receptors (Mesiano et al., 2002). In most species, progesterone decreases and estrogen increases during the weeks that precede parturition. These changes allow for the relaxation of the cervix as well as for contractility of the uterus to prepare the mother for delivery. This hormonal change has been demonstrated in cows, pigs, and goats (Thorburn et al., 1977). In most species, an increase in the oestrogen: progesterone ratio heightens myometrial contractility (Silver, 1990). Typically, in other species, a rise in estrogen concentration and a decrease in progesterone concentration cause this contractility. However, in the mare, the total progestagens rise in the days preceding parturition (Ousey et al., 1987). In the human, hormone activity resembles that of the mare (Mesiano et al., 2002). Silver

(1990) described the hormonal changes that occur in the mare to enhance myometrial stability, rather than contractility. Pashen (1984) stated that total estrogens decrease in the mare during the last 12 wk pre-partum; however, Barnes et al. (1975) reported that estradiol 17-β may rise prior to parturition in the mare.

Ousey (2004) stated that in the mare estradiol 17-β concentrations may increase or decrease due to photoperiod rather than the stage of gestation, which may explain the variability found in several studies. O'Donnell et al. (2003) observed in pony mares that estradiol 17-β concentrations demonstrated a nocturnal increase during late gestation and mares experienced contractions during the night over the last six days of pregnancy. This was speculated to be the cause for most mares foaling during the night hours. Ousey (2004) also stated that initiation of myometrial activity may be due to an increase of specific estrogens which promote the release of prostaglandins and oxytocin. Estradiol 17-β was shown by Haluska and Currie (1988) to increase significantly prior to parturition in pony mares. They also found the estradiol 17-β: progesterone ratio to increase, although this was not statistically significant. It was suggested by Seamans et al. (1979) that the importance of progesterone in parturition may be different among species given the variation in progesterone patterns at parturition.

Lammoglia et al. (1997) studied body temperature and endocrine interactions before and after calving in beef cows. Factors which affected body temperature included the time of the day, the sex of the calf, and the time before calving. The effects of calf sex on the cow's body temperature were evident before the pre-partum decline in body temperature. Cows that were carrying male calves had higher body temperatures than those carrying female calves until the pre-partum temperature decrease, at which time temperatures were the same. It was also found that the sex of the calf was related to estradiol 17-β concentration. Lammoglia et al. (1997) cited that calf size and serum estrogen concentrations have been reported to be positively correlated. In the horse, however, the size of the foal depends on the mare and her uterine capacity (Ginther, 1992).

In summary, body temperature changes in other species prior to parturition, as the drop in progesterone is mirrored by a drop in temperature. Evidence suggests an inverse relationship in estradiol 17–β and progesterone concentrations near parturition in the mare as compared to other species. There is currently no information on comparisons of the sex and the weight of the neonate to the dam's body temperature and sex steroid levels during the peri-parturient period. Previous work in humans and other mammals suggest an investigation into these factors is warranted.

CHAPTER III

EXPERIMENTAL PROCEDURES

Horses

Nineteen pregnant Quarter Horse mares and one pregnant Thoroughbred mare were utilized in this study. All mares used were owned by the Department of Animal Science at Texas A&M University and had been previously implanted in the nuchal ligament with a microchip having an identification code and temperature-sensing capabilities (Electronic ID, Inc., Cleburne, Texas 76033). All mares utilized during this study were housed at the TAMU Horse Center, College Station, TX in accordance with the approved guidelines of the Institutional Agricultural Animal Care and Use Committee. The mares used in this study were maintained on native pastures and fed for maintenance or early lactation at an amount to fulfill or exceed the requirements for reproductive function as outlined by the National Research Council (1989). The diet consisted of a 13% crude protein commercially pelleted concentrate (Producer's Cooperative Association, Bryan, TX 77806). Mares were brought into paddocks in the evening when signs of impending foaling were observed. These signs were determined by visual inspection of the udder and teat fullness as well as milk strip tests that test for water hardness (J.T. Baker, A division of Mallinckrodt Baker, Inc., Phillipsburg, NJ). Mares that measured 4 or 5 on the water hardness strips, indicating high calcium levels were estimated to be nearing parturition based on a milk strip history from previous years. Once a mare appeared to be within a 24 to 48 h period before foaling she was placed in a 3.7 m x 7.3 m stall bedded with straw. All mares used in this study were familiar with the procedures and with stalling, and stress levels appeared to be minimal.

Sample Collection

Temperature readings were taken twice daily starting 2 wk prior to the expected foaling date and continued for 3 to 4 d after parturition at 0900 and 2100 +/- 30 min. The temperature was recorded using both a digital thermometer inserted approximately 5 cm rectally and a Destron Technologies® *Pocket Reader* or *Pocket Reader* EX to collect microchip information. Once signs suggested the mares were within 48 h of foaling, the mares were brought into stalls and their temperatures were recorded every 3 h at 0300, 0600, 0900, 1200, 1500, 1800, 2100, and 2400 +/- 30 min until foaling. Blood samples were drawn once daily for 2 wk prior to the mare's expected foaling date and for 3 to 4 days following parturition at 0900 +/- 30 min in tubes containing ethylenediaminetetraacetic acid (EDTA) to prevent coagulation. Each day the blood samples were spun at 1734 x g for 30 min by refrigerated centrifuge to separate the plasma from the blood cells. The plasma was transferred into micro-centrifuge tubes labeled with the mare's identification number for the study and the date the sample was drawn. The samples were stored in a freezer at -20 °C and later analyzed for progesterone and estradiol 17-β by RIA. Sex of the foal was recorded at foaling. The foal's weight was recorded within 24 h after foaling.

Statistical Analysis

Data were evaluated by linear regression to determine if correlations existed between rectal temperature and microchip temperature, progesterone and estradiol 17-β, temperature (both rectal and microchip) and progesterone, and temperature (both rectal and microchip) and estradiol 17-β. The data from rectal temperature and microchip temperature were also analyzed by analysis of variance (ANOVA) to evaluate any difference according to the time of day. Analysis of variance (ANOVA) was used to determine if sex of the neonate affected temperature, estradiol 17-β, and progesterone.

A simple logit model was then used to further evaluate the temperature data. To control for diurnal cycles, the data were split into morning and evening observations and differenced on the respective mean. This ensures that temperature changes are measured from the local means for the morning and evening. The literature currently existing expects the temperature indicators of foaling to occur within 24 h of the event, so the data for the 36 h leading up to foaling were evaluated. Additionally, because negative outcomes are required to fit the estimation technique, data for each horse for 48 to 72 h prior to foaling is included as an independent observation. The data for the 36 h prior to foaling is coded 1 for foal, and the data for the previous 36 h are coded 0 for no foal. Because foaling occurred at random times, the data were further split so that mares foaling within 6 h of the last temperature measurement could be evaluated separately from those that foaled between 6 to 12 h after the last measurement (W. Eller, Texas A&M University, College Station, TX, personal communication). All statistical analyses were performed using STATA statistical software (Stata Corp., College Station, TX).

CHAPTER IV

RESULTS

Parturition Data

The mares utilized in this study foaled more frequently during the night hours after 2100 and before 0700. Four mares foaled in the pasture between the hours of 2100 and 0700, before udder and milk strip signs led to their being brought into stalls. For mares that were brought in before foaling, the length of time mares were in stalls prior to parturition ranged from 0 to 6 d. Of the mares observed foaling, 1 of 16 (6.25%) foaled before 2100, 9 of 16 (56.25%) foaled after 2100 and before 2400, and 6 of 16 (37.5%) foaled after 2400 and before 0700. Ten foals were females and ten were male. All mares delivered normal, healthy foals with no foaling complications. Two mares, one of which foaled in the pasture, had retained placentas greater than 2 h post-partum, which were passed within 2 h after 20 IU oxytocin given i.v. at 3 h.

Temperature: Days Surrounding Parturition

Rectal and microchip temperature recordings collected for each data point were highly correlated ($r = .9995$, $P < 0.001$).

To establish if there was a diurnal effect, both the rectal and microchip temperatures were divided into 4 periods: "period 1" (2400-0559), "period 2" (0600-1159), "period 3" (1200-1559), and "period 4" (1600-2359). Statistical analysis was performed using ANOVA to establish any significant difference in temperatures between any of these 4 periods. Mean rectal temperature in period 2 was significantly lower (P < 0.05) than in period 1. Mean rectal temperature in period 2 was significantly lower (P < 0.001) than period 4. Mean microchip temperature in period 2 was significantly lower (P < 0.05) than in periods 1, 3 and 4. These data are shown in Figure 1, Table 1.

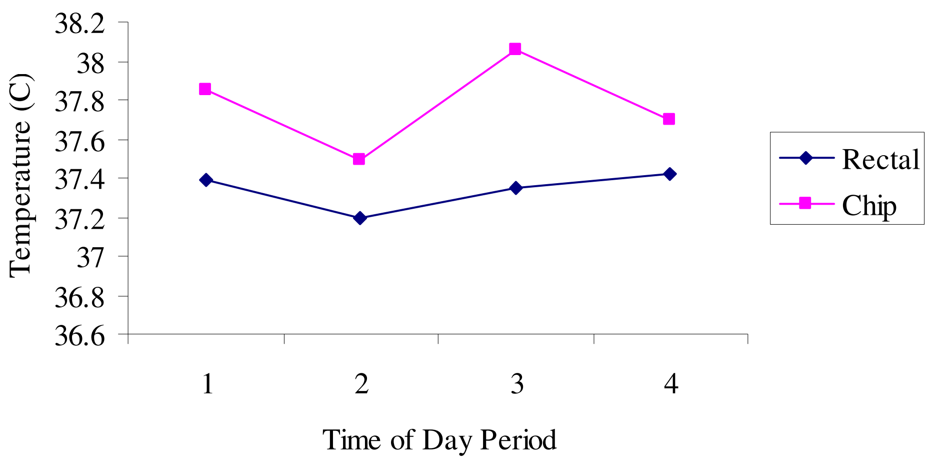

Figure 1. Mean temperature (°C) change of pregnant mares throughout 4 time of day periods

Table 1. Mean temperatures (± SEM) of pregnant mares during 4 time of day periods

Time of day period	Rectal Temperature (°C)	Microchip Temperature (°C)
1 (2400-0559)	37.4 ± .03[a]	37.9± .08[a]
2 (0600-1159)	37.2 ± .02[b]	37.5± .07[b]
3 (1200-1559)	37.4 ± .05[a,b]	38.1± .11[a]
4 (1600-2359)	37.4 ± .03[a]	37.7± 07[a]

[a,b]Values in same column with different superscripts are different (P < 0.05)

Using centered data and a logit model, 0900 and 2100 temperature data were analyzed to determine if the last temperature recorded could predict foaling. The differences between periods did not affect this data, as all mares except 1 foaled within 12 h of the 2100 temperature recording. Rectal temperature results for all mares demonstrate a significant (P < 0.05) temperature decrease when the last temperature recorded was within 12 h of parturition (Table 2). These mares were divided into two groups: "early" (mares foaling 0 to 6 h after the last temperature recording) and "late" (mares foaling 6 to 12 h after the last temperature recording). The early group demonstrated a significant (P < 0.05) decrease in temperature; however, the late group did not show this significant decrease.

Table 2. Mean temperature changes (± SEM) obtained from mares pre- and post- partum

Hour prior to parturition	Rectal Temperature (°C)	Microchip Temperature (°C)
60-72h[a]	0.072 ± .07	.241 ± .12
48-60h[a]	.112 ± .09	.341 ± .17
36-48h[a]	.146 ± .11	.446 ± .18
24-36h[a]	.074 ± .10	.206 ± .22
12-24h[a]	.013 ± .09	.075 ± .21
0-12h[b]	.083 ± .09	.184 ± .17

[a,b] Values in the same column with different superscripts are different (P < 0.05)

Temperature: Sex Effects

Data relating to sex were also analyzed for any significant difference in temperature. Means of all rectal temperatures for mares carrying males were analyzed with the means of all rectal temperatures for mares carrying females. The data were not significantly different whether the mare was carrying a male or female fetus (Table 3).

Table 3. Mean temperature (± SEM) obtained from pregnant mares according to neonate sex

Sex	Rectal Temperature (°C)	Microchip Temperature (°C)
Male	37.3 ± .02	37.6 ± .06[a]
Female	37.3 ± .02	37.8 ± .06[b]

[a,b] Values in same column with different superscripts are different ($P < 0.05$)

However, when the temperature data were obtained from the implanted microchip, means taken of all mares carrying males analyzed with means from all mares carrying females did demonstrate a significant difference ($P < 0.05$). The data showed that the mares in this study carrying females tended to have higher microchip temperature readings than did mares carrying males (Table 3).

Weight of Foal

There were no notable differences in the weights of the foals in this study to determine an appropriate grouping. Therefore, effects of a foal's birth weight on the mare's temperature, circulating progesterone, and circulating estradiol 17-β were not analyzed.

Temperature: Relationship with Progesterone and Estradiol 17-β

The data for 0900 rectal ($r = .8117$, $P < 0.001$) and microchip temperature ($r = .8106$, $P > 0.001$) demonstrated a positive significant correlation with the progesterone concentrations. Furthermore, data for 0900 rectal ($r = .8727$, $P < 0.001$) and microchip ($r = .8709$, $P < 0.001$) temperature recording methods demonstrated a positive significant correlation with the estradiol 17-β concentrations of the mares utilized in this study.

Relationship of Progesterone and Estradiol 17-β

The mean progesterone and estradiol 17-β concentrations were analyzed using linear regression and were found to be correlated ($r = .8569$, $P < 0.001$). Mean progesterone and estradiol 17-β concentrations both decreased as parturition approached. Mean progesterone concentrations decreased significantly ($P < 0.001$) between d -1 and d 0 (Figure 2). Mean estradiol 17-β concentrations decreased significantly ($P < 0.001$) between d -2 and d 0 and significantly ($P < 0.001$) between day -1 and 0 (Figure 3), however the decrease between d -2 and -1 was not statistically significant.

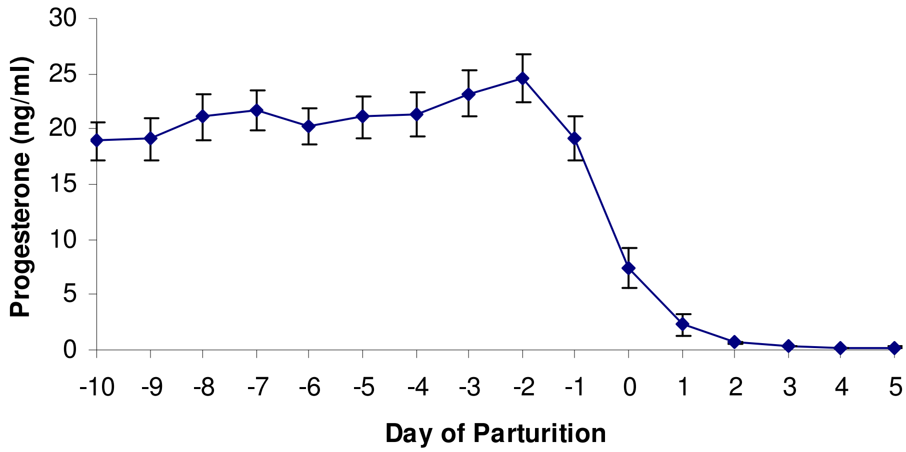

Figure 2. Mean progesterone concentrations of pregnant mares from d -10 to 5 of parturition

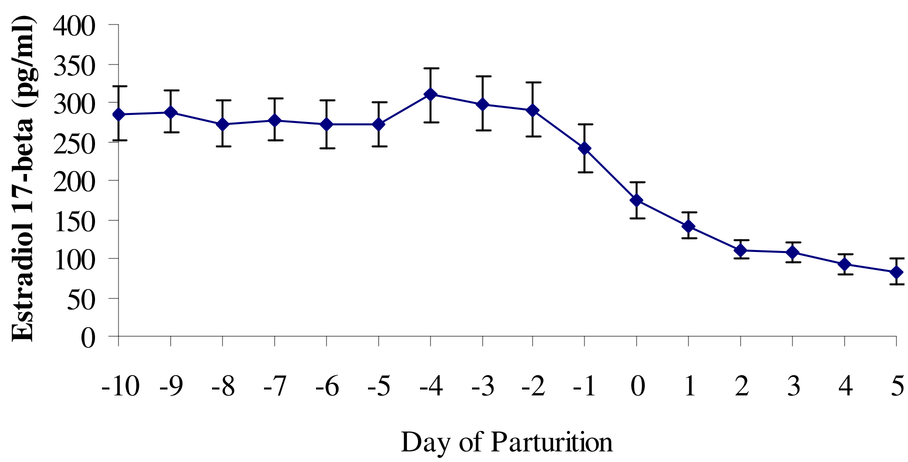

Figure 3. Mean estradiol 17-β concentrations of pregnant mares from d -10 to 5 of parturition

Effects of Fetal Sex on Progesterone and Estradiol 17-β

Analysis of variance was performed to compare progesterone and estradiol 17-β concentrations in mares carrying male and female foals. There were no significant differences present in circulating progesterone and estradiol 17-β concentrations in the mare relative to the sex of the foal (Figure 4 and Figure 5).

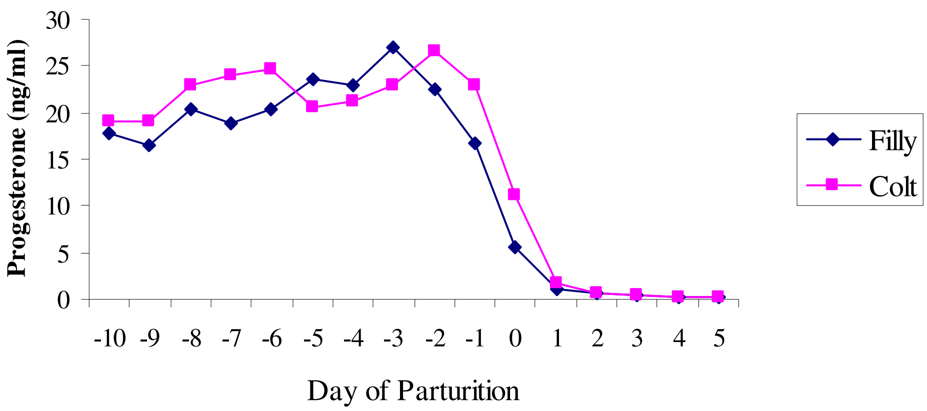

Figure 4. Influence of fetal sex on progesterone concentrations of pregnant mares from d -10 to 5 of parturition

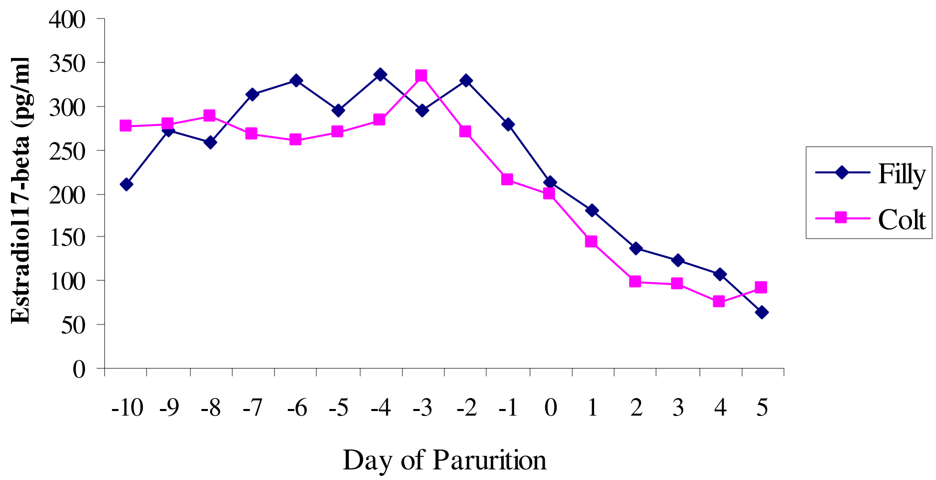

Figure 5. Influence of fetal sex on estradiol 17-β concentrations of pregnant mares from d -10 to 5 of parturition

CHAPTER V

GENERAL DISCUSSION

While limited, there is published research on body temperature (Cox, 1969; Haluska and Wilkins, 1989; Ammons et al., 1989; Cross, 1992) progesterone concentrations (Ousey et al., 1987; Ammons et al., 1989), and estradiol concentrations (Haluska and Currie, 1988; O'Donnell et al., 2003; Ousey, 2004) relative to the periparturient period in the mare. The results of this research agree with published literature with mares foaling most frequently at night. This is consistent with the data reported by Rossdale and Short (1967), Jeffcott (1972), Bain and Howey (1975), and Shaw et al. (1988).

A decrease in rectal temperature similar to what is seen on d -1 during the present study has also been reported previously. In the current study, the mean decline in rectal temperature of all temperatures taken throughout the day was 0.2 °C between d -2 and d -1. Cross (1992), using a radiotelemetric system, recorded a 0.76 °C fall in temperature within 4 hours of impending parturition; however, at $P < 0.1$, this decrease was not highly significant. In 1988, Shaw et al. found a 0.1 °C decrease in the average rectal temperature on d -1 of parturition. Haluska and Wilkins (1989) noted a significant fall in rectal temperature on d 0 of parturition. The pre-partum fall in rectal temperatures has also been demonstrated in cows (Wrenn et al., 1958; Ewbank, 1963), and sheep (Ewbank, 1969; Winfield and Makin, 1975). In contrast, neither Cox (1969) nor Ammons et al. (1989) saw a change in rectal temperature in the horse relative to parturition.

No change in mean temperature of all temperatures taken throughout the day during the days preceding parturition was detected using the microchip. However, the data did show a post-partum increase in mean temperature. This supports research published by Haluska and Wilkins (1989) demonstrating an increase in the mare's body temperature the day following parturition. Similar results have been observed in the sow (King et al., 1972). Rectal temperature data looking at the last temperature taken prior to parturition indicate there was a temperature decrease; however, it was only significant when this temperature was taken within 6 h of foaling.

Rectal temperature data did not show an effect of fetal sex on the mare's body temperature, although data obtained using the microchip showed mares carrying females to have significantly ($P < 0.05$) higher body temperatures than those carrying males. In beef cows, Lammoglia et al. (1997) demonstrated a difference in basal body temperature depending on the sex of the calf. However, in that case, cows carrying male calves had the higher temperature rather than those carrying female calves.

Because birth weights of the foals were within normal ranges and since there was no obvious difference in weights, these data were not subjected to statistical analyses.

The noted decline in rectal temperature could reflect the decrease in progesterone concentration in the mare. In other species, elevated levels of progesterone have been associated with an increase in temperature. However, in other species, progesterone decreases in the weeks prior to parturition (Thorburn et al., 1977), but the pre-partum decline in temperature is only seen in the days preceding parturition (Wrenn et al., Ewbank, 1963; Ewbank, 1969; Winfield and Makin, 1975). This delay in temperature decrease related to progesterone withdrawal suggests that the temperature decrease may be associated with events other than progesterone or in addition to it. In the current study, there was a significant ($P < 0.001$) relationship between the circulating concentrations of progesterone with the temperature data. In addition, estradiol 17-β and temperatures were correlated. Further research is needed to determine how these hormones may regulate body temperature the mare.

Haluska and Currie (1988) found the estradiol 17-β: progesterone ratio in pony mares to increase during the last 4 d preceding parturition, but this change was not significant. Barnes et al. (1975) found estradiol 17-β to increase up to the day preceding parturition. In the current study, there was no apparent change in the ratio of estradiol 17-β to progesterone prior to parturition.

Lammoglia et al. (1997) reported differences in estradiol 17-β concentrations between cows carrying male calves and those carrying female calves. Those carrying bull calves had higher estradiol concentrations from 144 to 56 h prior to calving. No significant relationship between fetal sex and circulating concentrations of progesterone and estradiol 17-β was seen in the present study. This is consistent with the findings of Haluska and Currie (1988).

CHAPTER VI

SUMMARY AND CONCLUSIONS

The utilization of changes in body temperature to predict the time of impending parturition has been successful in cattle and sheep, but is still questionable in the mare when measured via rectal thermometer. In the current study, rectal temperatures were not found to be a reliable predictor for parturition unless taken within 6 h or foaling. While data indicate a significant temperature decrease may occur prior to parturition, it occurs too close to this event to be of practical use. In addition, in order for body temperature to be used as a predictor for foaling time, a reliable method of detection readily usable by mare owners is needed. Unfortunately, the pre-foaling temperature decrease was not detected in this study using the nuchal ligament implants. Currently, the only method other than taking rectal temperatures that has demonstrated this pre-foaling temperature change (radio transmitter) is too invasive for practical use. Further research is needed using microchips or similar devices to determine whether temperature can be used to predict parturition.

In the present study, pre-partum progesterone profiles and body temperature in the mare were correlated. If progesterone does have effects on thermoregulation, a temperature decrease should be noted at the time of progesterone withdrawal. Further studies taking blood samples at every time that the temperature is monitored are needed to investigate whether a correlation does in fact exist between progesterone and body temperature.

This study found a positive correlation between progesterone and estradiol 17-β. Increases in the estradiol: progesterone ratio as parturition approaches have been examined in the mare (Haluska and Currie, 1988; Barnes et al., 1975); however, no significant changes have been reported. The photoperiod effect on estradiol 17-β reported by Ousey (2004) and the nocturnal contractions during late gestation (O'Donnell et al., 2003) may be related to the tendency of mares to foal during the night. Estradiol 17-β could have increased in the mares during the night hours utilized in this study; however, samples were only obtained during the morning. Further research is needed to determine whether estradiol 17-β does in fact increase in the mare in the hours prior to parturition.

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APPENDICES

APPENDIX 1. Correlation of rectal and microchip temperatures

RECTAL	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R-squared
CHIP	0.9898858	0.0010636	930.73	0.000	0.9877982	0.9919735	0.9991

APPENDIX 2A. Correlation of rectal temperature and progesterone

P4	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R-squared
RECTAL	0.415566	0.0206341	20.14	0.00	0.3748895	0.4562426	0.6589

APPENDIX 2B. Correlation of microchip temperature and progesterone

P4	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R-squared
CHIP	0.4097356	0.0204742	20.01	0.00	0.3693732	0.4500979	0.6571

APPENDIX 3A. Anova table for rectal temperature by sex

Source	Partial SS	df	MS	F	P-value
Model	0.04719534	1	0.0471953	0.24	0.6256
Sex	0.04719534	1	0.0471953	0.24	0.6256
Residual	164.585422	831	0.1980571		
Total	164.632617	832	0.1978757		

APPENDIX 3B. Anova table for microchip temperature by sex

Source	Partial SS	df	MS	F	P-value
Model	8.53496154	1	8.5349615	6.07	0.014
Sex	8.53496154	1	8.5349615	6.07	0.014
Residual	1159.16366	824	1.406752		
Total	1167.69862	825	1.4153923		

APPENDIX 4A. Anova table for progesterone by sex

Source	Partial SS	df	MS	F	P-value
Model	131.852215	1	131.85222	1.05	0.3062
Sex	131.852215	1	131.85222	1.05	0.3062
Residual	17630.5348	141	125.03925		
Total	17762.387	142	125.08723		

APPENDIX 4B. Anova table for estradiol by sex

Source	Partial SS	df	MS	F	P-value
Model	12845.7606	1	12845.761	0.77	0.3821
Sex	12845.7606	1	12845.761	0.77	0.3821
Residual	2440538.48	146	16716.017		
Total	2453384.24	147	16689.689		

APPENDIX 5A. Correlation of rectal temperature and estradiol

Estradiol	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R-squared
RECTAL	6.122976	0.2303874	26.58	0.00	5.668938	6.577013	0.7617

APPENDIX 5B. Correlation of microchip temperature and estradiol

Estradiol	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R-squared
CHIP	6.026896	0.2292285	26.29	0.00	5.575131	6.47866	0.7586

APPENDIX 6A. Anova table for progesterone by day

Source	Partial SS	df	MS	F	P-value
Model	18219.6388	15	1214.6426	28.61	0.00
Day	18219.6388	15	1214.6426	28.61	0.00
Residual	8448.98814	199	42.457227		
Total	26668.6269	214	124.61975		

APPENDIX 6B. Anova table for estradiol by day

Source	Partial SS	df	MS	F	P-value
Model	1366245.79	15	91083.052	8.40	0.00
Day	1366245.79	15	91083.052	8.40	0.00
Residual	2277883.02	210	10847.062		
Total	3644128.8	225	16196.128		

APPENDIX 7A. Anova table for rectal temps time of day effect

Source	Partial SS	df	MS	F	P-value
Model	9.6033	3	3.2011	17.11	0.00
TOD	9.6033	3	3.2011	17.11	0.00
Residual	154.9425	828	0.187128		
Total	164.545866	831	0.198009		

APPENDIX 7B. Anova table for chip temps time of day effect

Source	Partial SS	df	MS	F	P-value
Model	25.36619	3	8.45539	6.09	0.0004
TOD	25.36619	3	8.45539	6.09	0.0004
Residual	1140.38522	821	1.389019		
Total	1165.75142	824	1.41474		

APPENDIX 8A. Anova table for early evening category chip temps

Source	Partial SS	df	MS	F	P-value
Model	4.76232	4	1.19058	1.87	0.1312
Day	4.76232	4	1.19058	1.87	0.1312
Residual	31.915681	50	0.638313		
Total	36.6780062	54	0.6792223		

APPENDIX 8B. Anova table for early morning category chip temps

Source	Partial SS	df	MS	F	P-value
Model	1.018662	5	0.2037325	0.32	0.8983
Day	1.018662	5	0.2037325	0.32	0.8983
Residual	52.48632	83	0.632365		
Total	53.50498	88	0.608011		

APPENDIX 8C. Anova table for late evening category chip temps

Source	Partial SS	df	MS	F	P-value
Model	10.74337	6	1.790562	1.41	0.2146
Day	10.74337	6	1.790562	1.41	0.2146
Residual	164.81766	130	1.26782		
Total	175.56104	136	1.29089		

APPENDIX 8D. Anova table for late morning category chip temps

Source	Partial SS	df	MS	F	P-value
Model	16.91235	9	1.87915	1.94	0.0486
Day	16.91235	9	1.87915	1.94	0.0486
Residual	196.94273	203	0.9701612		
Total	213.85508	212	1.0087504		

APPENDIX 9A. Anova table for early evening category rectal temps

Source	Partial SS	df	MS	F	P-value
Model	0.662423	4	0.165605	1.05	0.3901
Day	0.662423	4	0.165605	1.05	0.3901
Residual	8.193774	52	0.1575725		
Total	8.856198	56	0.1581464		

APPENDIX 9B. Anova table for early morning category rectal temps

Source	Partial SS	df	MS	F	P-value
Model	1.300618	5	0.2601237	2.52	0.0358
Day	1.300618	5	0.2601237	2.52	0.0358
Residual	8.466554	82	0.1032507		
Total	9.767173	87	0.1122663		

APPENDIX 9C. Anova table for late evening category rectal temps

Source	Partial SS	df	MS	F	P-value
Model	1.1284183	6	0.1880697	1.47	0.194
Day	1.1284183	6	0.1880697	1.47	0.194
Residual	16.6514647	130	0.1280882		
Total	17.779883	136	0.1307344		

APPENDIX 9D. Anova table for late morning category rectal temps

Source	Partial SS	df	MS	F	P-value
Model	4.67386212	9	0.519318	3.59	0.0004
Day	4.67386212	9	0.519318	3.59	0.0004
Residual	29.37567	203	0.1447077		
Total	34.0495321	212	0.160611		

APPENDIX 10A. Anova table for rectal temperature pre- and post- parturition

Source	Partial SS	df	MS	F	P-value
Model	2.45445639	5	0.4908913	3.55	0.0038
Day	2.4544564	5	0.4908913	3.55	0.0038
Residual	54.5257923	394	0.1383903		
Total	56.9802487	399	0.1428076		

APPENDIX 10B. Anova table for microchip temperature pre- and post-parturition

Source	Partial SS	df	MS	F	P-value
Model	9.32622416	5	1.8652448	2.79	0.0173
Day	9.32622416	5	1.8652448	2.79	0.0173
Residual	263.921184	394	0.6690227		
Total	272.921184	399			

APPENDIX 11. TEMPERATURE, WEIGHT AND SEX RECORDS

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
1	21-Feb	900	-12	-303	37.4	99.4			c	135
1	21-Feb	2100	-12	-291	37.7	99.9			c	135
1	22-Feb	900	-11	-279	37.8	100.0			c	135
1	22-Feb	2100	-11	-267	37.5	99.5	38.1	100.5	c	135
1	23-Feb	900	-10	-255	37.4	99.4	36.6	97.8	c	135
1	23-Feb	2100	-10	-243	37.6	99.7	37.6	99.6	c	135
1	24-Feb	900	-9	-231	37.4	99.3	36.1	96.9	c	135
1	24-Feb	2100	-9	-219	37.3	99.1	37.0	98.6	c	135
1	25-Feb	900	-8	-207	37.2	98.9	36.4	97.6	c	135
1	25-Feb	2100	-8	-195	37.6	99.6	36.4	97.6	c	135
1	26-Feb	900	-7	-183	37.4	99.3	38.1	100.5	c	135
1	26-Feb	2100	-7	-171	37.7	99.8	38.2	100.7	c	135
1	27-Feb	900	-6	-159	37.2	98.9	37.6	99.6	c	135
1	27-Feb	2100	-6	-147	37.6	99.6	35.6	96.0	c	135
1	28-Feb	900	-5	-135	36.5	97.7	38.2	100.7	c	135
1	28-Feb	2100	-5	-123	36.9	98.4	36.2	97.1	c	135
1	1-Mar	900	-4	-111	37.1	98.8	37.6	99.6	c	135
1	1-Mar	2100	-4	-99	37.2	99.0	38.2	100.8	c	135
1	2-Mar	900	-3	-87	37.0	98.6	36.2	97.1	c	135
1	2-Mar	2100	-3	-75	37.8	100.1	38.1	100.5	c	135
1	3-Mar	900	-2	-63	35.8	96.4	37.7	99.8	c	135
1	3-Mar	2100	-2	-51	37.6	99.7	38.1	100.5	c	135
1	4-Mar	2400	-1	-48	37.6	99.7	38.2	100.7	c	135
1	4-Mar	300	-1	-45	37.4	99.3	37.6	99.7	c	135
1	4-Mar	600	-1	-42	37.6	99.7	37.9	100.3	c	135
1	4-Mar	900	-1	-39	36.6	97.8	38.6	101.4	c	135
1	4-Mar	1200	-1	-36	37.6	99.6	37.0	98.6	c	135
1	4-Mar	1500	-1	-33	36.6	97.8	37.1	98.8	c	135
1	4-Mar	1800	-1	-30	37.3	99.1	38.2	100.7	c	135
1	4-Mar	2100	-1	-27	37.9	100.2	38.3	100.9	c	135
1	5-Mar	2400	0	-24	37.7	99.8	38.1	100.5	c	135
1	5-Mar	300	0	-21	37.4	99.3	38.2	100.7	c	135
1	5-Mar	600	0	-18	37.6	99.7	38.2	100.7	c	135
1	5-Mar	900	0	-15	37.3	99.1	38.2	100.7	c	135
1	5-Mar	1200	0	-12	37.2	99.0	38.1	100.5	c	135
1	5-Mar	1500	0	-9	37.5	99.5	38.6	101.4	c	135
1	5-Mar	1800	0	-6	37.6	99.7	38.2	100.7	c	135
1	5-Mar	2100	0	-3	37.8	100.0	38.4	101.2	c	135
1	6-Mar	900	1	9	37.7	99.8	38.9	102.1	c	135
1	6-Mar	2100	1	21	37.3	99.1	38.1	100.5	c	135
1	7-Mar	900	2	33	37.8	100.0	39.1	102.3	c	135
1	8-Mar	900	3	45	37.3	99.1	37.9	100.3	c	135
1	9-Mar	900	4	69	36.9	98.5	38.1	100.5	c	135
3	23-Feb	900	-10	-246	37.4	99.4	36.2	97.1	c	
3	23-Feb	2100	-10	-234	37.5	99.5	36.6	97.8	c	
3	24-Feb	900	-9	-222	37.0	98.6	36.4	97.6	c	
3	24-Feb	2100	-9	-210	37.1	98.8	37.3	99.1	c	
3	25-Feb	900	-8	-198	37.3	99.2	33.2	91.7	c	
3	25-Feb	2100	-8	-186	37.0	98.6	35.3	95.5	c	
3	26-Feb	900	-7	-174	37.3	99.1	34.2	93.5	c	
3	26-Feb	2100	-7	-162	36.7	98.1	37.1	98.7	c	
3	27-Feb	900	-6	-150	33.7	92.7			c	
3	27-Feb	1200	-6	-138	36.9	98.5	37.1	98.7	c	
3	27-Feb	2100	-6	-129	36.3	97.3	37.1	98.7	c	
3	28-Feb	300	-5	-123	37.0	98.6	36.6	97.9	c	

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
3	28-Feb	600	-5	-120	37.2	98.9	35.8	96.4	c	
3	28-Feb	900	-5	-117	36.7	98.1	37.3	99.1	c	
3	28-Feb	1200	-5	-114	37.4	99.3	37.6	99.6	c	
3	28-Feb	1500	-5	-111	37.6	99.6	36.9	98.5	c	
3	28-Feb	1800	-5	-108	36.8	98.2	36.3	97.3	c	
3	28-Feb	2100	-5	-105	36.7	98.1	36.7	98.0	c	
3	1-Mar	2400	-4	-102	37.3	99.1	36.9	98.5	c	
3	1-Mar	300	-4	-99	37.6	99.7	35.8	96.4	c	
3	1-Mar	600	-4	-96	36.6	97.9	36.1	96.9	c	
3	1-Mar	900	-4	-93	36.2	97.2	37.1	98.7	c	
3	1-Mar	2100	-4	-81	36.4	97.6	36.6	97.8	c	
3	2-Mar	2400	-3	-78	37.5	99.5	37.1	98.7	c	
3	2-Mar	300	-3	-75	37.3	99.2	36.6	97.8	c	
3	2-Mar	600	-3	-72	37.4	99.3	36.6	97.8	c	
3	2-Mar	900	-3	-69	37.1	98.8	36.7	98.0	c	
3	2-Mar	1200	-3	-66	37.4	99.4	36.7	98.0	c	
3	2-Mar	1500	-3	-63	37.5	99.5	37.1	98.7	c	
3	2-Mar	1800	-3	-60	37.7	99.8	37.1	98.7	c	
3	2-Mar	2100	-3	-57	37.3	99.2	36.9	98.5	c	
3	3-Mar	2400	-2	-54	37.1	98.7	36.1	96.9	c	
3	3-Mar	300	-2	-51	37.0	98.6	36.6	97.8	c	
3	3-Mar	600	-2	-48	37.6	99.6	36.9	98.5	c	
3	3-Mar	900	-2	-45	37.9	100.3	37.6	99.6	c	
3	3-Mar	1200	-2	-42	37.8	100.0	37.2	98.9	c	
3	3-Mar	1500	-2	-39	37.7	99.8	37.2	98.9	c	
3	3-Mar	1800	-2	-36	37.7	99.8	37.2	98.9	c	
3	3-Mar	2100	-2	-33	37.8	100.0	37.4	99.4	c	
3	4-Mar	2400	-1	-30	37.4	99.3	36.6	97.8	c	
3	4-Mar	300	-1	-27	37.0	98.6	36.1	96.9	c	
3	4-Mar	600	-1	-24	37.2	99.0	35.8	96.4	c	
3	4-Mar	900	-1	-21	37.1	98.7	36.7	98.0	c	
3	4-Mar	1200	-1	-18	36.9	98.5	37.1	98.8	c	
3	4-Mar	1500	-1	-15	36.7	98.0	37.1	98.7	c	
3	4-Mar	1800	-1	-12	37.5	99.5	37.1	98.7	c	
3	4-Mar	2100	-1	-9	37.6	99.7	36.7	98.0	c	
3	5-Mar	2400	0	-6	37.2	99.0	36.6	97.8	c	
3	5-Mar	300	0	-3	37.1	98.7	36.7	98.0	c	
3	5-Mar	600	0	3			36.1	96.9	c	
3	5-Mar	900	0	6	36.9	98.5	37.1	98.7	c	
3	5-Mar	2100	0	18	37.5	99.5	37.3	99.1	c	
3	6-Mar	900	1	30	37.6	99.6	37.2	98.9	c	
3	7-Mar	900	2	54	37.6	99.7	36.4	97.6	c	
3	8-Mar	900	3	78	37.5	99.5	33.6	92.4	c	
3	9-Mar	900	4	102	37.2	99.0	33.8	92.8	c	
4	24-Feb	900	-5	-135	36.2	97.2			f	133
4	24-Feb	2100	-5	-123	37.4	99.4	37.1	98.7	f	133
4	25-Feb	900	-4	-111	37.4	99.3			f	133
4	25-Feb	2100	-4	-99	37.3	99.2	28.1	82.5	f	133
4	26-Feb	900	-3	-87	37.0	98.6	32.6	90.6	f	133
4	26-Feb	2100	-3	-75	37.4	99.3	38.2	100.7	f	133
4	27-Feb	900	-2	-63	37.2	98.9			f	133
4	27-Feb	1800	-2	-54	37.3	99.2	38.1	100.5	f	133
4	27-Feb	2100	-2	-51	37.1	98.7	38.3	100.9	f	133
4	28-Feb	2400	-1	-48	37.3	99.1	37.6	99.6	f	133
4	28-Feb	300	-1	-45	37.1	98.8	37.7	99.8	f	133
4	28-Feb	600	-1	-42	36.9	98.4	38.2	100.7	f	133

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
4	28-Feb	900	-1	-39	36.9	98.5	38.1	100.5	f	133
4	28-Feb	1200	-1	-36	37.0	98.6	37.6	99.6	f	133
4	28-Feb	1500	-1	-33	37.2	99.0	37.7	99.8	f	133
4	28-Feb	1800	-1	-30	37.3	99.1	37.2	98.9	f	133
4	28-Feb	2100	-1	-27	37.7	99.8	38.3	100.9	f	133
4	1-Mar	2400	0	-24	37.3	99.1	37.2	98.9	f	133
4	1-Mar	300	0	-21	37.1	98.8	37.7	99.8	f	133
4	1-Mar	600	0	-18	36.9	98.4	38.2	100.7	f	133
4	1-Mar	900	0	-15	36.9	98.5	38.1	100.5	f	133
4	1-Mar	1200	0	-12	36.8	98.3	38.6	101.4	f	133
4	1-Mar	1500	0	-9	37.7	99.8	38.2	100.7	f	133
4	1-Mar	1800	0	-6	37.4	99.4	38.6	101.4	f	133
4	1-Mar	2100	0	-3	37.0	98.6	37.9	100.3	f	133
4	2-Mar	2400	1	3	36.5	97.7	35.6	96.0	f	133
4	2-Mar	900	1	12	37.0	98.6	39.1	102.3	f	133
4	2-Mar	2100	1	36	37.5	99.5	39.1	102.3	f	133
4	3-Mar	900	2	60	37.8	100.1	39.1	102.3	f	133
4	3-Mar	2100	2	72	37.4	99.4	39.2	102.6	f	133
4	4-Mar	900	3	84	37.0	98.6	37.6	99.6	f	133
4	5-Mar	900	4	108	36.5	97.7	36.1	96.9	f	133
5	24-Feb	900	-18	-417	36.8	98.2	37.1	98.7	f	120
5	24-Feb	2100	-18	-405	37.3	99.1	37.6	99.6	f	120
5	25-Feb	900	-17	-393	37.8	100.0	36.2	97.1	f	120
5	25-Feb	2100	-17	-381	37.5	99.5	37.1	98.7	f	120
5	26-Feb	900	-16	-369	36.4	97.5	37.1	98.7	f	120
5	26-Feb	2100	-16	-357	37.3	99.1	37.4	99.4	f	120
5	27-Feb	900	-15	-345	37.1	98.8			f	120
5	27-Feb	2100	-15	-333	37.4	99.3	37.6	99.6	f	120
5	28-Feb	900	-14	-321	36.7	98.0	37.3	99.1	f	120
5	28-Feb	2100	-14	-309	36.8	98.3	37.3	99.1	f	120
5	1-Mar	900	-13	-297	36.5	97.7	37.3	99.1	f	120
5	1-Mar	2100	-13	-285	36.8	98.2	37.1	98.7	f	120
5	2-Mar	900	-12	-273	37.1	98.8	37.3	99.1	f	120
5	2-Mar	2100	-12	-261	37.7	99.9	37.7	99.8	f	120
5	3-Mar	900	-11	-249	36.4	97.5	37.4	99.4	f	120
5	3-Mar	2100	-11	-237	36.8	98.3	38.6	101.4	f	120
5	4-Mar	900	-10	-225	36.3	97.4	37.2	98.9	f	120
5	4-Mar	2100	-10	-213	37.6	99.6	37.1	98.7	f	120
5	5-Mar	900	-9	-201	37.3	99.1	37.1	98.7	f	120
5	5-Mar	2100	-9	-189	37.9	100.2	37.6	99.6	f	120
5	6-Mar	900	-8	-177	37.4	99.4	37.1	98.7	f	120
5	6-Mar	2100	-8	-165	37.2	98.9	37.3	99.1	f	120
5	7-Mar	900	-7	-153	37.4	99.3	37.6	99.6	f	120
5	7-Mar	2100	-7	-141	37.2	98.9	37.1	98.7	f	120
5	8-Mar	900	-6	-129	36.8	98.2	37.1	98.7	f	120
5	8-Mar	2100	-6	-117	36.9	98.5	37.3	99.1	f	120
5	9-Mar	900	-5	-105	37.2	98.9	37.1	98.7	f	120
5	9-Mar	2100	-5	-93	37.8	100.0	37.1	98.7	f	120
5	10-Mar	900	-4	-81	36.7	98.1	37.2	98.9	f	120
5	10-Mar	2100	-4	-69	37.7	99.8	37.1	98.7	f	120
5	11-Mar	900	-3	-57	36.9	98.4	37.6	99.6	f	120
5	11-Mar	2100	-3	-45	38.6	101.5	38.1	100.6	f	120
5	12-Mar	2400	-2	-42	37.4	99.4	38.0	100.4	f	120
5	12-Mar	300	-2	-39	38.1	100.6	37.4	99.4	f	120
5	12-Mar	600	-2	-36	37.8	100.1	37.4	99.4	f	120
5	12-Mar	900	-2	-33	37.7	99.8	37.2	98.9	f	120

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
5	12-Mar	2100	-2	-30	37.6	99.6	37.6	99.6	f	120
5	13-Mar	2400	-1	-27	37.3	99.1	37.9	100.2	f	120
5	13-Mar	300	-1	-24	37.4	99.4	37.1	98.7	f	120
5	13-Mar	600	-1	-12	37.2	98.9	37.1	98.7	f	120
5	13-Mar	900	-1	-9	37.6	99.7	37.4	99.4	f	120
5	13-Mar	2100	-1	-6	37.3	99.2	37.2	98.9	f	120
5	14-Mar	2400	0	-3	37.4	99.4	37.8	100.1	f	120
5	15-Mar	900	1	6	37.5	99.5	37.1	98.7	f	120
5	16-Mar	900	2	30	37.4	99.3	37.6	99.6	f	120
5	17-Mar	900	3	54	37.2	98.9	37.4	99.3	f	120
5	18-Mar	900	4	76	36.6	97.8	37.1	98.7	f	120
6	27-Feb	900	-12	-303	37.3	99.1			c	118
6	27-Feb	2100	-12	-291	37.7	99.9	38.4	101.2	c	118
6	28-Feb	900	-11	-279	35.7	96.3	38.1	100.5	c	118
6	28-Feb	2100	-11	-267	36.4	97.5	37.7	99.8	c	118
6	1-Mar	900	-10	-255	36.7	98.1	37.9	100.3	c	118
6	1-Mar	2100	-10	-243	37.4	99.4	38.1	100.5	c	118
6	2-Mar	900	-9	-231	35.7	96.3	37.6	99.6	c	118
6	2-Mar	2100	-9	-219	37.8	100.0	38.4	101.2	c	118
6	3-Mar	900	-8	-207	37.1	98.8	38.2	100.7	c	118
6	3-Mar	2100	-8	-195	36.6	97.9	38.2	100.7	c	118
6	4-Mar	900	-7	-183	36.7	98.0	38.1	100.5	c	118
6	4-Mar	2100	-7	-171	37.4	99.4	37.9	100.3	c	118
6	5-Mar	900	-6	-159	37.3	99.1	37.6	99.6	c	118
6	5-Mar	2100	-6	-147	37.0	98.6	38.2	100.7	c	118
6	6-Mar	900	-5	-135	37.1	98.7	38.1	100.5	c	118
6	6-Mar	2100	-5	-123	37.3	99.1	38.6	101.4	c	118
6	7-Mar	900	-4	-111	37.2	99.0	38.2	100.7	c	118
6	7-Mar	2100	-4	-99	37.7	99.9	38.4	101.2	c	118
6	8-Mar	2400	-3	-96	37.7	99.9	38.1	100.5	c	118
6	8-Mar	300	-3	-93	37.8	100.0	38.1	100.5	c	118
6	8-Mar	600	-3	-90	37.6	99.7	37.7	99.8	c	118
6	8-Mar	900	-3	-87	37.3	99.1	37.6	99.6	c	118
6	8-Mar	1800	-3	-78	37.4	99.4	38.4	101.2	c	118
6	8-Mar	2100	-3	-75	37.3	99.1	38.2	100.7	c	118
6	9-Mar	2400	-2	-72	37.8	100.1	38.3	100.9	c	118
6	9-Mar	300	-2	-69	37.7	99.8	38.0	100.4	c	118
6	9-Mar	600	-2	-66	37.8	100.0	38.1	100.5	c	118
6	9-Mar	900	-2	-63	37.2	98.9	37.4	99.4	c	118
6	9-Mar	2100	-2	-51	37.7	99.8	38.4	101.2	c	118
6	10-Mar	2400	-1	-48	37.4	99.3	38.2	100.7	c	118
6	10-Mar	300	-1	-45	37.5	99.5	37.9	100.3	c	118
6	10-Mar	600	-1	-42	37.6	99.6	37.7	99.8	c	118
6	10-Mar	900	-1	-39	37.4	99.3	38.1	100.5	c	118
6	10-Mar	1200	-1	-36	36.7	98.1	38.1	100.5	c	118
6	10-Mar	1800	-1	-30	37.4	99.4	38.2	100.7	c	118
6	10-Mar	2100	-1	-27	37.5	99.5	38.1	100.5	c	118
6	11-Mar	2400	0	-24	37.4	99.3	38.2	100.7	c	118
6	11-Mar	300	0	-21	37.6	99.6	37.9	100.3	c	118
6	11-Mar	600	0	-18	37.6	99.6	38.1	100.5	c	118
6	11-Mar	900	0	-15	37.4	99.3	38.1	100.5	c	118
6	11-Mar	2100	0	-3	37.4	99.3	37.9	100.3	c	118
6	12-Mar	2100	1	24	38.1	100.6	38.6	101.4	c	118
6	15-Mar	900	4	36	37.5	99.5	36.1	96.9	c	118
6	16-Mar	900	5	50	37.6	99.6	38.2	100.7	c	118
7	8-Mar	900	-7	74	36.9	98.4	36.7	98.1	f	112

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
7	8-Mar	2100	-7	-168	37.7	99.8	36.6	97.8	f	112
7	9-Mar	900	-6	-156	37.0	98.6	36.6	97.8	f	112
7	9-Mar	2100	-6	-144	37.7	99.8	37.2	98.9	f	112
7	10-Mar	900	-5	-132	37.4	99.3	38.1	100.5	f	112
7	10-Mar	2100	-5	-120	37.4	99.4	37.2	98.9	f	112
7	11-Mar	900	-4	-108	37.4	99.4	37.6	99.6	f	112
7	11-Mar	2100	-4	-96	37.8	100.0	37.6	99.6	f	112
7	12-Mar	900	-3	-84	37.6	99.7	37.7	99.8	f	112
7	12-Mar	2100	-3	-72	37.9	100.2	36.9	98.5	f	112
7	13-Mar	900	-2	-60	37.5	99.5	37.6	99.6	f	112
7	13-Mar	2100	-2	-48	37.6	99.6	36.6	97.8	f	112
7	14-Mar	900	-1	-36	36.8	98.2	37.2	98.9	f	112
7	14-Mar	2100	-1	-24	36.6	97.8	36.2	97.1	f	112
7	15-Mar	900	0	-12	36.8	98.2	35.8	96.4	f	112
7	15-Mar	2100	0	0			36.4	97.6	f	112
7	16-Mar	900	1	12	37.3	99.1	37.7	99.8	f	112
7	16-Mar	2100	1	24	37.9	100.3	38.1	100.5	f	112
7	17-Mar	900	2	36	37.1	98.7	38.4	101.2	f	112
7	18-Mar	900	3	50	37.6	99.6	37.1	98.7	f	112
7	19-Mar	900	4	74	37.8	100.0	36.1	96.9	f	112
8	8-Mar	900	-10	-255	36.7	98.1	37.7	99.8	c	112
8	8-Mar	2100	-10	-243	37.4	99.4	38.8	101.8	c	112
8	9-Mar	900	-9	-231	37.1	98.7	37.6	99.6	c	112
8	9-Mar	2100	-9	-219	37.3	99.1	38.8	101.8	c	112
8	10-Mar	900	-8	-207	36.9	98.5	38.4	101.2	c	112
8	10-Mar	2100	-8	-195	37.6	99.6	38.6	101.4	c	112
8	11-Mar	900	-7	-183	37.6	99.7	38.6	101.4	c	112
8	11-Mar	2100	-7	-171	37.8	100.0	38.6	101.4	c	112
8	12-Mar	900	-6	-159	37.5	99.5	38.6	101.4	c	112
8	12-Mar	2100	-6	-147	37.8	100.0	38.8	101.8	c	112
8	13-Mar	900	-5	-135	37.5	99.5	37.6	99.6	c	112
8	13-Mar	2100	-5	-123	37.6	99.6	38.2	100.7	c	112
8	14-Mar	900	-4	-111	36.7	98.1	36.7	98.0	c	112
8	14-Mar	2100	-4	-99	37.6	99.7	38.6	101.4	c	112
8	15-Mar	900	-3	-87	36.6	97.9	36.1	96.9	c	112
8	15-Mar	2100	-3	-75	37.3	99.2	37.6	99.6	c	112
8	16-Mar	900	-2	-63	37.2	99.0	38.1	100.5	c	112
8	16-Mar	2100	-2	-51	37.9	100.3	38.9	102.1	c	112
8	17-Mar	900	-1	-39	36.7	98.1	38.1	100.5	c	112
8	17-Mar	2100	-1	-27	37.3	99.2	38.6	101.4	c	112
8	18-Mar	2400	0	-24	37.5	99.5	38.3	100.9	c	112
8	18-Mar	300	0	-21	37.2	98.9	38.1	100.5	c	112
8	18-Mar	600	0	-18	37.6	99.7	37.9	100.3	c	112
8	18-Mar	900	0	-15	36.8	98.2	37.1	98.7	c	112
8	18-Mar	1200	0	-12	37.0	98.6	37.4	99.4	c	112
8	18-Mar	1500	0	-9	37.1	98.7	37.9	100.3	c	112
8	18-Mar	1800	0	-6	37.3	99.1	38.1	100.5	c	112
8	18-Mar	2100	0	-3	36.7	98.0	38.2	100.7	c	112
8	19-Mar	900	1	9	37.6	99.7	39.1	102.3	c	112
8	20-Mar	900	2	33	37.5	99.5	39.1	102.3	c	112
8	21-Mar	900	3	57	37.4	99.4	38.8	101.8	c	112
8	22-Mar	900	4	81	37.6	99.6	38.6	101.4	c	112
9	8-Mar	900	-13	-327	36.8	98.2	37.9	100.2	f	128
9	8-Mar	2100	-13	-315	37.8	100.1	38.6	101.4	f	128
9	9-Mar	900	-12	-303	37.4	99.3	38.1	100.5	f	128
9	9-Mar	2100	-12	-291	37.7	99.8	38.9	102.1	f	128

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
9	10-Mar	900	-11	-279	37.1	98.7	38.3	100.9	f	128
9	10-Mar	2100	-11	-267	37.7	99.9	38.8	101.8	f	128
9	11-Mar	900	-10	-255	37.8	100.0	38.9	102.1	f	128
9	11-Mar	1930	-10	-244.5	38.3	100.9	38.9	102.1	f	128
9	11-Mar	2100	-10	-243	37.7	99.8	38.8	101.8	f	128
9	12-Mar	2400	-9	-240	37.8	100.1	38.4	101.2	f	128
9	12-Mar	300	-9	-237	37.6	99.6	38.4	101.2	f	128
9	12-Mar	600	-9	-234	37.4	99.4	38.4	101.2	f	128
9	12-Mar	900	-9	-231	37.6	99.7	37.9	100.2	f	128
9	12-Mar	2100	-9	-219	37.9	100.2	38.6	101.4	f	128
9	12-Mar	2200	-9	-218	37.4	99.4	38.4	101.2	f	128
9	13-Mar	2400	-8	-216	37.6	99.6	38.4	101.2	f	128
9	13-Mar	300	-8	-213	37.2	98.9	38.6	101.4	f	128
9	13-Mar	600	-8	-210	37.9	100.2	38.6	101.4	f	128
9	13-Mar	900	-8	-207	36.9	98.4	38.6	101.4	f	128
9	13-Mar	2100	-8	-195	37.6	99.7	38.4	101.2	f	128
9	14-Mar	2400	-7	-192	37.4	99.3	38.4	101.2	f	128
9	14-Mar	430	-7	-187.5	37.5	99.5	37.6	99.6	f	128
9	14-Mar	600	-7	-186	37.0	98.6	37.6	99.6	f	128
9	14-Mar	900	-7	-183	37.1	98.8	38.0	100.4	f	128
9	14-Mar	2100	-7	-171	37.8	100.0	38.4	101.2	f	128
9	15-Mar	900	-6	-159	37.2	98.9	37.7	99.8	f	128
9	15-Mar	2100	-6	-147	36.9	98.5	38.4	101.2	f	128
9	16-Mar	2400	-5	-144	37.5	99.5	38.8	101.8	f	128
9	16-Mar	300	-5	-141	37.8	100.0	38.4	101.2	f	128
9	16-Mar	600	-5	-138	37.8	100.0	38.4	101.1	f	128
9	16-Mar	900	-5	-135	37.5	99.5	38.2	100.7	f	128
9	16-Mar	2100	-5	-123	37.3	99.1	38.6	101.4	f	128
9	17-Mar	2400	-4	-120	37.2	99.0	38.6	101.4	f	128
9	17-Mar	300	-4	-117	37.5	99.5	38.6	101.4	f	128
9	17-Mar	600	-4	-114	37.2	98.9	38.1	100.5	f	128
9	17-Mar	900	-4	-111	37.3	99.2	38.2	100.7	f	128
9	17-Mar	1800	-4	-102	37.9	100.2	39.1	102.3	f	128
9	17-Mar	2100	-4	-99	37.3	99.1	38.6	101.4	f	128
9	18-Mar	2400	-3	-96	37.4	99.4	38.3	100.9	f	128
9	18-Mar	300	-3	-93	37.5	99.5	38.6	101.4	f	128
9	18-Mar	600	-3	-90	37.6	99.6	38.6	101.4	f	128
9	18-Mar	900	-3	-87	37.3	99.1	38.1	100.5	f	128
9	18-Mar	1200	-3	-84	37.5	99.5	38.1	100.5	f	128
9	18-Mar	1500	-3	-81	37.4	99.3	38.4	101.2	f	128
9	18-Mar	1800	-3	-78	37.3	99.2	38.6	101.4	f	128
9	18-Mar	2100	-3	-75	37.8	100.0	38.6	101.4	f	128
9	18-Mar	2330	-3	-72.5	36.1	96.9	38.3	100.9	f	128
9	19-Mar	300	-2	-69	37.8	100.0	38.6	101.4	f	128
9	19-Mar	730	-2	-64.5	37.1	98.8	37.6	99.6	f	128
9	19-Mar	900	-2	-63	37.7	99.8	37.7	99.8	f	128
9	19-Mar	1200	-2	-60	37.2	98.9	38.6	101.4	f	128
9	19-Mar	1500	-2	-57	37.2	99.0	38.8	101.8	f	128
9	19-Mar	1800	-2	-54	37.7	99.9	38.8	101.8	f	128
9	19-Mar	2100	-2	-51	38.1	100.6	39.1	102.3	f	128
9	20-Mar	900	-1	-39	36.7	98.0	37.6	99.6	f	128
9	20-Mar	2100	-1	-27	37.9	100.2	38.6	101.4	f	128
9	21-Mar	2400	0	-24	36.9	98.4	38.8	101.8	f	128
9	21-Mar	300	0	-21	36.6	97.9	38.3	100.9	f	128
9	21-Mar	600	0	-18	37.2	99.0	38.7	101.7	f	128
9	21-Mar	900	0	-15	37.4	99.4	38.6	101.4	f	128

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
9	21-Mar	1200	0	-12	37.1	98.8	38.6	101.4	f	128
9	21-Mar	1500	0	-9	37.4	99.3	38.6	101.4	f	128
9	21-Mar	1800	0	-6	36.9	98.5	38.9	102.1	f	128
9	21-Mar	2100	0	-3	37.5	99.5	38.9	102.1	f	128
9	22-Mar	2400	1	3	37.6	99.7	38.4	101.2	f	128
9	22-Mar	300	1	6	37.2	98.9	39.3	102.7	f	128
9	22-Mar	900	1	12	38.0	100.4	38.9	102.1	f	128
9	22-Mar	2100	1	24	37.6	99.7	39.2	102.5	f	128
9	23-Mar	900	2	36	37.4	99.3	39.1	102.3	f	128
9	24-Mar	900	3	50	37.9	100.3	39.1	102.3	f	128
9	25-Mar	900	4	74	37.4	99.3	39.2	102.5	f	128
9	26-Mar	900	5	98	38.6	101.5	39.9	103.9	f	128
10	3-Mar	2400	-1	-48	37.7	99.8	38.1	100.5	c	118
10	3-Mar	300	-1	-45	37.3	99.1	37.6	99.6	c	118
10	3-Mar	600	-1	-42	37.5	99.5	37.1	98.7	c	118
10	3-Mar	900	-1	-39	37.6	99.7	38.1	100.5	c	118
10	3-Mar	1800	-1	-30	36.7	98.1	38.1	100.5	c	118
10	3-Mar	2100	-1	-27	37.8	100.0	38.4	101.2	c	118
10	4-Mar	2400	0	-24	37.7	99.9	38.1	100.5	c	118
10	4-Mar	300	0	-21	37.6	99.7	37.6	99.6	c	118
10	4-Mar	600	0	-18	37.5	99.5	37.6	99.6	c	118
10	4-Mar	900	0	-15	37.0	98.6	38.2	100.7	c	118
10	4-Mar	1200	0	-12	38.4	101.2	37.0	98.6	c	118
10	4-Mar	1500	0	-9	37.6	99.6	36.3	97.4	c	118
10	4-Mar	1800	0	-6	36.9	98.5	38.1	100.5	c	118
10	4-Mar	2100	0	-3	37.1	98.7	37.7	99.8	c	118
10	5-Mar	2400	1	3	36.7	98.1	36.7	98.0	c	118
10	5-Mar	900	1	12	37.1	98.8	38.8	101.8	c	118
11	15-Mar	900	-26	-627	36.4	97.6	35.4	95.8	c	114
11	15-Mar	2100	-26	-615	37.3	99.2	36.2	97.1	c	114
11	16-Mar	900	-25	-603	36.7	98.0	36.0	96.8	c	114
11	16-Mar	2100	-25	-591	37.1	98.7	37.7	99.8	c	114
11	17-Mar	900	-24	-579	37.0	98.6	37.6	99.6	c	114
11	17-Mar	2100	-24	-567	37.4	99.3	37.6	99.6	c	114
11	18-Mar	900	-23	-555	36.7	98.1	35.3	95.5	c	114
11	18-Mar	2100	-23	-543	37.2	99.0	36.3	97.3	c	114
11	19-Mar	900	-22	-531	37.0	98.6	34.7	94.4	c	114
11	19-Mar	2100	-22	-519	37.8	100.0	38.4	101.2	c	114
11	20-Mar	900	-21	-1014	37.1	98.8	35.1	95.1	c	114
11	20-Mar	2100	-21	507	36.2	97.2	36.7	98.0	c	114
11	21-Mar	900	-20	-495	37.0	98.6	37.6	99.6	c	114
11	21-Mar	2100	-20	-483	37.4	99.3	36.3	97.3	c	114
11	22-Mar	900	-19	-471	36.6	97.9	38.4	101.2	c	114
11	22-Mar	2100	-19	-459	37.4	99.4	36.1	96.9	c	114
11	23-Mar	900	-18	-447	37.1	98.8	34.7	94.4	c	114
11	23-Mar	2100	-18	-435	37.2	99.0	33.1	91.5	c	114
11	24-Mar	900	-17	-423	36.2	97.1	39.2	102.5	c	114
11	24-Mar	2100	-17	-411	37.2	99.0	37.4	99.4	c	114
11	25-Mar	900	-16	-399	37.1	98.7	39.6	103.2	c	114
11	25-Mar	2100	-16	-387	37.5	99.5	37.2	98.9	c	114
11	26-Mar	900	-15	-375	36.9	98.4	37.7	99.8	c	114
11	26-Mar	2100	-15	-363	37.0	98.6	37.4	99.4	c	114
11	27-Mar	900	-14	-351	36.0	96.8	37.3	99.1	c	114
11	27-Mar	2100	-14	-339	38.1	100.5	38.4	101.2	c	114
11	28-Mar	900	-13	-327	37.3	99.2	32.3	90.1	c	114
11	28-Mar	2100	-13	-315	38.1	100.5	37.6	99.6	c	114

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
11	29-Mar	900	-12	-303	37.3	99.1	37.1	98.7	c	114
11	29-Mar	2100	-12	-291	36.9	98.4	37.9	100.3	c	114
11	30-Mar	900	-11	-279	37.2	99.0	37.6	99.6	c	114
11	30-Mar	2100	-11	-267	37.6	99.7	37.1	98.7	c	114
11	31-Mar	900	-10	-255	37.5	99.5	38.3	100.9	c	114
11	31-Mar	2100	-10	-243	36.5	97.7	38.1	100.5	c	114
11	1-Apr	900	-9	-231	37.2	98.9	37.2	98.9	c	114
11	1-Apr	2100	-9	-219	36.6	97.9	36.7	98.0	c	114
11	2-Apr	900	-8	-207	37.4	99.4	37.7	99.8	c	114
11	2-Apr	2100	-8	-195	37.9	100.2	37.6	99.6	c	114
11	3-Apr	900	-7	-183	37.2	99.0	37.4	99.4	c	114
11	3-Apr	2100	-7	-171	37.8	100.1	38.6	101.4	c	114
11	4-Apr	900	-6	-159	37.1	98.8	38.1	100.5	c	114
11	4-Apr	2100	-6	-147	37.9	100.2	38.6	101.4	c	114
11	5-Apr	900	-5	-135	37.1	98.7	36.9	98.5	c	114
11	5-Apr	2100	-5	-123	37.7	99.9	37.6	99.6	c	114
11	6-Apr	900	-4	-111	37.0	98.6	36.9	98.5	c	114
11	6-Apr	2100	-4	-99	36.7	98.0	37.9	100.3	c	114
11	7-Apr	900	-3	-87	37.4	99.3	38.3	100.9	c	114
11	7-Apr	2100	-3	-75	37.8	100.0	38.6	101.4	c	114
11	8-Apr	2400	-2	-72	37.2	99.0	38.4	101.2	c	114
11	8-Apr	300	-2	-69	36.6	97.9	37.2	98.9	c	114
11	8-Apr	600	-2	-66	37.6	99.7	36.7	98.0	c	114
11	8-Apr	900	-2	-63	36.6	97.9	37.1	98.7	c	114
11	8-Apr	1200	-2	-60	37.3	99.2	37.4	99.4	c	114
11	8-Apr	1500	-2	-57	37.4	99.4	38.1	100.5	c	114
11	8-Apr	1800	-2	-54	37.6	99.7	38.1	100.5	c	114
11	8-Apr	2100	-2	-51	38.2	100.7	37.7	99.9	c	114
11	9-Apr	2400	-1	-48	37.6	99.7	38.2	100.7	c	114
11	9-Apr	300	-1	-45	37.5	99.5	36.9	98.5	c	114
11	9-Apr	600	-1	-42	37.3	99.1	36.7	98.0	c	114
11	9-Apr	900	-1	-39	37.6	99.6	39.1	102.3	c	114
11	9-Apr	1200	-1	-36	37.2	98.9	38.1	100.5	c	114
11	9-Apr	1500	-1	-33	37.6	99.6	38.2	100.7	c	114
11	9-Apr	1800	-1	-30	37.3	99.2	38.4	101.2	c	114
11	9-Apr	2100	-1	-27	37.5	99.5	38.6	101.4	c	114
11	10-Apr	2400	-1	-24	37.4	99.4	37.1	98.7	c	114
11	10-Apr	300	0	-21	37.2	98.9	37.1	98.7	c	114
11	10-Apr	600	0	-18	36.4	97.5	36.2	97.1	c	114
11	10-Apr	900	0	-15	37.1	98.8	38.2	100.7	c	114
11	10-Apr	1200	0	-12	37.3	99.1	37.7	99.8	c	114
11	10-Apr	1500	0	-9	37.3	99.1	38.6	101.4	c	114
11	10-Apr	1800	0	-6	37.5	99.5	38.3	100.9	c	114
11	10-Apr	2100	0	-3	37.2	99.0	38.6	101.4	c	114
11	11-Apr	2400	1	3	36.9	98.5	36.8	98.2	c	114
11	11-Apr	300	1	6	37.4	99.4	37.8	100.0	c	114
11	11-Apr	900	1	12	37.9	100.3	38.1	100.5	c	114
11	12-Apr	900	2	36	37.6	99.7	37.6	99.6	c	114
11	13-Apr	900	3	60	37.7	99.8	39.3	102.7	c	114
11	14-Apr	900	4	84	37.5	99.5	37.8	100.1	c	114
11	15-Apr	900	5	108	37.3	99.2	37.7	99.8	c	114
12	16-Mar	900	-12	-282	37.0	98.6	37.3	99.1	f	102
12	16-Mar	2100	-12	-279	36.6	97.9	37.6	99.6	f	102
12	17-Mar	900	-11	-258	36.6	97.8	37.3	99.1	f	102
12	17-Mar	2100	-11	-246	37.1	98.8	37.3	99.1	f	102
12	18-Mar	900	-10	-234	36.2	97.1	35.8	96.4	f	102

APPENDIX 1. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
12	18-Mar	2100	-10	-222	35.1	95.1	36.7	98.0	f	102
12	19-Mar	900	-9	-210	37.0	98.6	35.6	96.0	f	102
12	19-Mar	2100	-9	-198	37.5	99.5	37.6	99.6	f	102
12	20-Mar	900	-8	-186	36.8	98.2	33.8	92.8	f	102
12	20-Mar	2100	-8	-174	35.7	96.3	36.9	98.5	f	102
12	21-Mar	900	-7	-162	36.6	97.9	36.6	97.8	f	102
12	21-Mar	2100	-7	-150	35.8	96.5	37.1	98.7	f	102
12	22-Mar	900	-6	-138	37.0	98.6	35.3	95.5	f	102
12	22-Mar	2100	-6	-126	37.1	98.7	37.6	99.6	f	102
12	23-Mar	900	-5	-114	36.7	98.1	35.6	96.0	f	102
12	23-Mar	2100	-5	-102	37.7	99.8	35.8	96.4	f	102
12	24-Mar	900	-4	-90	35.9	96.7	37.6	99.6	f	102
12	24-Mar	2100	-4	-78	37.3	99.1	37.9	100.3	f	102
12	25-Mar	900	-3	-66	37.0	98.6	38.4	101.2	f	102
12	25-Mar	2100	-3	-54	37.3	99.2	37.6	99.6	f	102
12	26-Mar	900	-2	-42	36.7	98.1	38.3	100.9	f	102
12	26-Mar	2100	-2	-30	36.9	98.4	37.6	99.6	f	102
12	27-Mar	2400	-1	-27	37.5	99.5	37.9	100.3	f	102
12	27-Mar	300	-1	-24	37.0	98.6	37.4	99.4	f	102
12	27-Mar	600	-1	-21	36.9	98.4	37.3	99.1	f	102
12	27-Mar	900	-1	-18	37.0	98.6	37.6	99.6	f	102
12	27-Mar	1200	-1	-15	37.1	98.7	37.2	98.9	f	102
12	27-Mar	1500	-1	-12	36.9	98.5	37.2	98.9	f	102
12	27-Mar	1800	-1	-9	36.9	98.5	37.6	99.6	f	102
12	27-Mar	2100	-1	-6	36.9	98.4	37.3	99.1	f	102
12	28-Mar	2400	0	-3	37.0	98.6	37.3	99.1	f	102
12	28-Mar	200	0	3	36.3	97.3	37.1	98.7	f	102
12	28-Mar	300	0	3	37.7	99.9	36.4	97.6	f	102
12	28-Mar	900	0	6	37.1	98.7	37.6	99.6	f	102
12	28-Mar	2100	0	18	37.7	99.9	37.6	99.6	f	102
12	29-Mar	900	1	30	37.4	99.4	37.7	99.8	f	102
12	30-Mar	900	2	54	37.1	98.8	38.2	100.7	f	102
12	31-Mar	900	3	78	37.9	100.2	38.4	101.2	f	102
12	1-Apr	900	4	102	37.6	99.7	37.4	99.4	f	102
12	2-Apr	900	5	126	37.0	98.6	38.1	100.5	f	102
14	28-Mar	900	-12	-303	37.7	99.9	36.7	98.0	c	120
14	28-Mar	2100	-12	-291	37.8	100.1	38.1	100.5	c	120
14	29-Mar	900	-11	-279	37.2	98.9	38.6	101.4	c	120
14	29-Mar	2100	-11	-267	37.6	99.6	38.1	100.5	c	120
14	30-Mar	900	-10	-255	37.2	98.9	38.4	101.2	c	120
14	30-Mar	2100	-10	-243	37.6	99.6	38.4	101.2	c	120
14	31-Mar	900	-9	-231	37.3	99.1	38.6	101.4	c	120
14	31-Mar	2100	-9	-219	37.7	99.8	38.6	101.4	c	120
14	1-Apr	900	-8	-207	37.2	98.9	38.6	101.4	c	120
14	1-Apr	2100	-8	-195	36.8	98.2	38.2	100.7	c	120
14	2-Apr	900	-7	-183	37.3	99.1	38.4	101.2	c	120
14	2-Apr	2100	-7	-171	37.5	99.5	38.8	101.8	c	120
14	3-Apr	900	-6	-159	37.3	99.2	38.6	101.4	c	120
14	3-Apr	2100	-6	-147	37.4	99.3	38.3	100.9	c	120
14	4-Apr	900	-5	-135	37.1	98.8	38.6	101.4	c	120
14	4-Apr	2100	-5	-123	37.5	99.5	38.6	101.4	c	120
14	4-Apr	2400	-5	-120	37.9	100.2	38.8	101.8	c	120
14	4-Apr	300	-5	-117	37.2	98.9	38.4	101.2	c	120
14	4-Apr	600	-5	-114			38.4	101.2	c	120
14	5-Apr	900	-4	-111	37.3	99.1	38.8	101.8	c	120
14	5-Apr	1200	-4	-108	37.2	98.9	38.7	101.6	c	120

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
14	5-Apr	1500	-4	-105	37.8	100.0	38.9	102.1	c	120
14	5-Apr	1800	-4	-102	37.7	99.8	38.9	102.1	c	120
14	5-Apr	2100	-4	-99	37.7	99.8	38.6	101.4	c	120
14	6-Apr	2400	-3	-96	37.7	99.8	38.6	101.4	c	120
14	6-Apr	300	-3	-93	37.6	99.7	37.9	100.3	c	120
14	6-Apr	600	-3	-90	37.6	99.7	38.1	100.5	c	120
14	6-Apr	900	-3	-87	37.4	99.3	38.6	101.4	c	120
14	6-Apr	1200	-3	-84	37.1	98.7	39.1	102.3	c	120
14	6-Apr	1500	-3	-81	37.3	99.1	39.1	102.3	c	120
14	6-Apr	1800	-3	-78	37.6	99.6	39.2	102.5	c	120
14	6-Apr	2100	-3	-75	37.5	99.5	38.8	101.8	c	120
14	7-Apr	2400	-2	-72	37.9	100.2	38.6	101.4	c	120
14	7-Apr	400	-2	-68	37.9	100.2	38.2	100.7	c	120
14	7-Apr	600	-2	-66	37.9	100.2	38.1	100.6	c	120
14	7-Apr	900	-2	-63	37.4	99.3	38.9	102.1	c	120
14	7-Apr	1200	-2	-60	37.6	99.7	39.3	102.8	c	120
14	7-Apr	1500	-2	-57	38.3	100.9	39.7	103.4	c	120
14	7-Apr	1800	-2	-54	37.8	100.0	38.9	102.1	c	120
14	7-Apr	2100	-2	-51	37.6	99.7	38.9	102.1	c	120
14	8-Apr	2400	-1	-48	37.7	99.9	38.6	101.4	c	120
14	8-Apr	300	-1	-45	37.9	100.2	37.4	99.4	c	120
14	8-Apr	600	-1	-42	37.4	99.3	37.9	100.3	c	120
14	8-Apr	900	-1	-39	37.0	98.6	38.6	101.4	c	120
14	8-Apr	1200	-1	-36	37.2	99.0	38.8	101.8	c	120
14	8-Apr	1500	-1	-33	37.2	99.0	38.6	101.4	c	120
14	8-Apr	1800	-1	-30	37.2	98.9	38.8	101.8	c	120
14	8-Apr	2100	-1	-27	37.9	100.2	39.1	102.3	c	120
14	9-Apr	2400	0	-24	37.3	99.1	38.8	101.8	c	120
14	9-Apr	300	0	-21	37.9	100.2	38.2	100.8	c	120
14	9-Apr	600	0	-18	37.4	99.4	38.2	100.7	c	120
14	9-Apr	900	0	-15	37.2	99.0	38.1	100.5	c	120
14	9-Apr	1200	0	-12	37.2	99.0	38.6	101.4	c	120
14	9-Apr	1500	0	-9	37.2	99.0	38.8	101.8	c	120
14	9-Apr	1800	0	-6	37.5	99.5	38.6	101.4	c	120
14	9-Apr	2100	0	-3	37.7	99.9	38.9	102.1	c	120
14	10-Apr	2400	1	3	36.9	98.5	38.1	100.5	c	120
14	10-Apr	200	1	3	37.3	99.2	38.9	102.1	c	120
14	10-Apr	300	1	6	37.7	99.8	38.6	101.4	c	120
14	10-Apr	900	1	9	37.8	100.0	39.1	102.3	c	120
14	10-Apr	2100	1	21	37.8	100.0	39.1	102.3	c	120
14	11-Apr	900	2	33	37.4	99.4	38.9	102.1	c	120
14	11-Apr	2100	2	45	38.1	100.5	39.4	103.0	c	120
14	12-Apr	900	3	57	37.9	100.2	38.9	102.1	c	120
14	13-Apr	900	4	81	37.1	98.7	38.9	102.1	c	120
14	14-Apr	900	5	105	37.4	99.3	39.1	102.4	c	120
15	27-Mar	900	-5	-156	36.9	98.4	37.9	100.3	f	95
15	27-Mar	2100	-5	-132	37.9	100.2	38.6	101.4	f	95
15	28-Mar	900	-4	-108	37.0	98.6	34.6	94.2	f	95
15	28-Mar	2100	-4	-96	37.6	99.7	38.2	100.7	f	95
15	29-Mar	900	-3	-84	37.4	99.3	37.7	99.8	f	95
15	29-Mar	2100	-3	-72	37.6	99.7	38.1	100.5	f	95
15	30-Mar	900	-2	-60	36.8	98.3	38.1	100.5	f	95
15	30-Mar	2100	-2	-48	37.6	99.7	38.6	101.4	f	95
15	31-Mar	2400	-1	-45	37.3	99.2	38.2	100.7	f	95
15	31-Mar	300	-1	-42	37.5	99.5	38.1	100.5	f	95
15	31-Mar	600	-1	-39	37.3	99.2	38.1	100.5	f	95

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
15	31-Mar	900	-1	-36	37.7	99.8	38.6	101.4	f	95
15	31-Mar	1200	-1	-33	37.8	100.0	37.7	99.8	f	95
15	31-Mar	1500	-1	-30	37.6	99.7	38.6	101.4	f	95
15	31-Mar	1800	-1	-27	37.4	99.4	38.2	100.7	f	95
15	31-Mar	2100	-1	-24	37.4	99.4	38.3	100.9	f	95
15	1-Apr	2400	0	-21	37.6	99.7	38.2	100.7	f	95
15	1-Apr	300	0	-18	37.6	99.7	38.2	100.7	f	95
15	1-Apr	600	0	-15	37.4	99.3	38.2	100.7	f	95
15	1-Apr	900	0	-12	37.2	99.0	38.1	100.5	f	95
15	1-Apr	1200	0	-9	36.9	98.5			f	95
15	1-Apr	1500	0	-6	37.4	99.4			f	95
15	1-Apr	1800	0	-3	37.2	98.9			f	95
15	1-Apr	2100	0	3	37.3	99.1	38.1	100.5	f	95
15	1-Apr	2230	0	3	38.1	100.6	38.6	101.4	f	95
15	2-Apr	900	1	15	37.2	98.9	38.6	101.4	f	95
15	2-Apr	2100	1	27	37.9	100.2	38.8	101.8	f	95
15	3-Apr	900	2	39	37.8	100.0	38.6	101.4	f	95
15	4-Apr	900	3	63	37.3	99.1	38.2	100.7	f	95
15	5-Apr	900	4	87	37.6	99.6	38.2	100.7	f	95
15	6-Apr	900	5	111	37.3	99.1	38.1	100.5	f	95
16	28-Mar	900	-16		37.6	99.7	37.6	99.6	f	
16	28-Mar	2100	-16		37.9	100.2	38.9	102.1	f	
16	29-Mar	900	-15		37.2	98.9	38.6	101.4	f	
16	29-Mar	2100	-15		37.1	98.8	38.4	101.2	f	
16	30-Mar	900	-14		36.2	97.2	38.6	101.4	f	
16	30-Mar	2100	-14		37.6	99.7	38.6	101.4	f	
16	31-Mar	900	-13		37.3	99.1	38.8	101.8	f	
16	31-Mar	2100	-13		36.7	98.0	38.6	101.4	f	
16	1-Apr	900	-12		37.3	99.1	39.1	102.3	f	
16	1-Apr	2100	-12		37.6	99.6	38.6	101.4	f	
16	2-Apr	900	-11		37.6	99.7	38.4	101.2	f	
16	2-Apr	2100	-11		37.8	100.0	38.9	102.1	f	
16	3-Apr	900	-10		37.4	99.4	38.6	101.4	f	
16	3-Apr	2100	-10		37.8	100.0	38.6	101.4	f	
16	4-Apr	900	-9		37.6	99.7	38.9	102.1	f	
16	4-Apr	2100	-9		37.6	99.7	38.9	102.1	f	
16	5-Apr	900	-8		37.4	99.3	38.2	100.7	f	
16	5-Apr	2100	-8		37.4	99.4	38.4	101.2	f	
16	6-Apr	900	-7		37.3	99.1	38.4	101.2	f	
16	6-Apr	2100	-7		37.7	99.9	38.9	102.1	f	
16	7-Apr	900	-6		37.4	99.3	39.1	102.3	f	
16	7-Apr	2100	-6		37.4	99.3	39.1	102.3	f	
16	8-Apr	900	-5		37.2	99.0	37.4	99.4	f	
16	8-Apr	2100	-5		37.5	99.5	38.4	101.2	f	
16	9-Apr	900	-4		37.4	99.3	37.9	100.3	f	
16	9-Apr	2100	-4		37.6	99.7	38.8	101.8	f	
16	10-Apr	900	-3		37.0	98.6	38.1	100.5	f	
16	10-Apr	2100	-3		37.6	99.6	38.6	101.4	f	
16	11-Apr	900	-2		37.5	99.5	38.6	101.4	f	
16	11-Apr	2100	-2		37.6	99.7	38.8	101.8	f	
16	12-Apr	900	-1		37.3	99.1	38.6	101.4	f	
16	12-Apr	2100	-1		37.4	99.4	38.8	101.8	f	
16	13-Apr	900	0		37.6	99.6	38.8	101.8	f	
16	13-Apr	2100	0		37.7	99.8	38.6	101.4	f	
16	14-Apr	900	1		37.3	99.1	38.6	101.4	f	
16	14-Apr	2100	1		37.4	99.4	38.6	101.4	f	

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
16	15-Apr	900	2		37.2	98.9	39.2	102.5	f	
16	16-Apr	900	3		37.8	100.1	38.9	102.1	f	
16	17-Apr	900	4		37.8	100.0	39.2	102.5	f	
16	18-Apr	900	5		37.9	100.2	38.9	102.1	f	
16	19-Apr	900	6		37.6	99.7	39.1	102.3	f	
17	5-Apr	2100	-8	-177	37.5	99.5	36.3	97.3	f	
17	6-Apr	900	-7	-165	36.9	98.5	36.6	97.8	f	
17	6-Apr	2100	-7	-153	37.0	98.6	37.1	98.7	f	
17	7-Apr	900	-6	-141	37.2	99.0	37.2	98.9	f	
17	7-Apr	2100	-6	-129	37.6	99.7	36.6	97.8	f	
17	8-Apr	900	-5	-117	36.9	98.4	32.3	90.1	f	
17	8-Apr	2100	-5	-105	37.5	99.5	35.3	95.5	f	
17	9-Apr	900	-4	-93	36.9	98.5	36.6	97.8	f	
17	9-Apr	2100	-4	-81	37.8	100.1	37.1	98.7	f	
17	10-Apr	900	-3	-69	37.4	99.3	37.1	98.7	f	
17	10-Apr	2100	-3	-57	37.2	98.9	36.4	97.6	f	
17	11-Apr	900	-2	-45	37.0	98.6	36.4	97.6	f	
17	11-Apr	2100	-2	-33	37.4	99.4	36.4	97.6	f	
17	12-Apr	900	-1	-21	37.3	99.1	36.6	97.8	f	
17	12-Apr	2100	-1	-9	37.5	99.5	36.7	98.0	f	
17	13-Apr	900	0	3			37.1	98.7	f	
17	13-Apr	1100	0	6	36.9	98.5	37.2	98.9	f	
17	13-Apr	2100	0	15	37.7	99.8	38.1	100.5	f	
17	14-Apr	900	1	27	37.7	99.9	37.9	100.3	f	
17	15-Apr	900	2	51	36.7	98.1	36.3	97.3	f	
17	16-Apr	900	3	75	37.9	100.2	37.6	99.6	f	
17	17-Apr	900	4	99	37.6	99.7	37.9	100.3	f	
17	18-Apr	900	5	123	37.4	99.4	37.1	98.7	f	
18	6-Apr	900	-14	-330	36.3	97.3	37.6	99.6	c	122
18	6-Apr	2100	-14	-318	37.3	99.1	38.3	100.9	c	122
18	7-Apr	900	-13	-306	36.8	98.2	38.2	100.7	c	122
18	7-Apr	2100	-13	-294	37.7	99.9	38.6	101.4	c	122
18	8-Apr	900	-12	-282	36.5	97.7	37.1	98.7	c	122
18	8-Apr	2100	-12	-270	36.3	97.4	37.7	99.8	c	122
18	9-Apr	900	-11	-258	36.4	97.5	37.2	98.9	c	122
18	9-Apr	2100	-11	-246	37.6	99.7	38.4	101.2	c	122
18	10-Apr	900	-10	-234	36.4	97.6	38.1	100.5	c	122
18	10-Apr	2100	-10	-222	37.3	99.1	38.2	100.7	c	122
18	11-Apr	900	-9	-210	36.6	97.9	37.6	99.6	c	122
18	11-Apr	2100	-9	-198	37.6	99.7	38.4	101.2	c	122
18	12-Apr	900	-8	-186	36.7	98.1	37.9	100.3	c	122
18	12-Apr	2100	-8	-174	37.9	100.2	38.6	101.4	c	122
18	13-Apr	900	-7	-162	37.1	98.8	38.3	100.9	c	122
18	13-Apr	2100	-7	-150	37.8	100.0	38.6	101.4	c	122
18	14-Apr	900	-6	-138	36.5	97.7	37.4	99.4	c	122
18	14-Apr	2100	-6	-126	37.4	99.4	37.9	100.3	c	122
18	15-Apr	900	-5	-114	36.2	97.2	37.2	98.9	c	122
18	15-Apr	2100	-5	-102	37.2	98.9	37.9	100.3	c	122
18	16-Apr	2400	-4	-99	37.4	99.3	38.1	100.5	c	122
18	16-Apr	300	-4	-96	37.6	99.6	38.6	101.4	c	122
18	16-Apr	600	-4	-93	37.6	99.7	38.6	101.4	c	122
18	16-Apr	900	-4	-90	37.5	99.5	38.9	102.1	c	122
18	16-Apr	1200	-4	-87	37.0	98.6	39.1	102.3	c	122
18	16-Apr	1500	-4	-84	37.9	100.3	39.1	102.3	c	122
18	16-Apr	1800	-4	-81	37.7	99.8	39.1	102.3	c	122
18	16-Apr	2100	-4	-78	37.8	100.1	39.1	102.3	c	122

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
18	17-Apr	2400	-3	-75	37.7	99.8	38.6	101.4	c	122
18	17-Apr	300	-3	-72	37.8	100.0	38.6	101.4	c	122
18	17-Apr	600	-3	-69	37.5	99.5	38.6	101.4	c	122
18	17-Apr	900	-3	-66	37.6	99.6	38.8	101.8	c	122
18	17-Apr	1200	-3	-63	37.8	100.0	39.3	102.8	c	122
18	17-Apr	1500	-3	-60	38.1	100.6	39.3	102.7	c	122
18	17-Apr	1800	-3	-57	38.0	100.4	39.1	102.3	c	122
18	17-Apr	2100	-3	-54	37.7	99.8	38.8	101.8	c	122
18	18-Apr	2400	-2	-51	37.8	100.0	38.9	102.1	c	122
18	18-Apr	300	-2	-48	37.1	98.7	38.9	102.1	c	122
18	18-Apr	600	-2	-45	36.7	98.1	38.4	101.2	c	122
18	18-Apr	900	-2	-42	37.4	99.4	38.6	101.4	c	122
18	18-Apr	1200	-2	-39	37.7	99.9	39.1	102.3	c	122
18	18-Apr	1500	-2	-36	36.7	98.1	38.6	101.4	c	122
18	18-Apr	1800	-2	-33	37.3	99.2	38.4	101.2	c	122
18	18-Apr	2100	-2	-30	37.7	99.8	38.4	101.2	c	122
18	19-Apr	2400	-1	-27	37.4	99.3	38.6	101.4	c	122
18	19-Apr	300	-1	-24	37.1	98.7	38.4	101.2	c	122
18	19-Apr	600	-1	-21	37.6	99.7	38.4	101.2	c	122
18	19-Apr	900	-1	-18	37.1	98.8	38.2	100.7	c	122
18	19-Apr	1200	-1	-15	37.3	99.2	38.6	101.4	c	122
18	19-Apr	1500	-1	-12	38.3	100.9	38.9	102.1	c	122
18	19-Apr	1800	-1	-9	37.4	99.3	38.2	100.7	c	122
18	19-Apr	2100	-1	-6	37.0	98.6	38.7	101.7	c	122
18	20-Apr	2400	0	-3	37.2	98.9	38.4	101.2	c	122
18	20-Apr	250	0	0			38.1	100.5	c	122
18	20-Apr	600	0	3	36.5	97.7	38.4	101.2	c	122
18	20-Apr	900	0	6	37.5	99.5	38.6	101.4	c	122
18	20-Apr	2100	0	18	37.8	100.1	39.1	102.3	c	122
18	21-Apr	900	1	30	37.7	99.9	39.1	102.3	c	122
18	22-Apr	900	2	54	37.8	100.1	39.1	102.3	c	122
18	23-Apr	900	3	78	37.7	99.9	38.6	101.4	c	122
18	24-Apr	900	4	102	37.8	100.0	38.9	102.1	c	122
18	25-Apr	900	5	126	37.8	100.0	38.6	101.4	c	122
19	1-May	900	-27	-642	37.3	99.1	35.8	96.4	c	
19	1-May	2100	-27	-630	37.0	98.6	36.2	97.1	c	
19	2-May	900	-26	-618	37.3	99.2	35.7	96.2	c	
19	2-May	2100	-26	-606	37.9	100.2	35.2	95.3	c	
19	3-May	900	-25	-594	36.7	98.1	37.1	98.7	c	
19	3-May	2100	-25	-582	36.5	97.7	36.1	96.9	c	
19	4-May	900	-24	-570	37.3	99.1	36.1	96.9	c	
19	4-May	2100	-24	-558	37.7	99.9	36.6	97.8	c	
19	5-May	900	-23	-546	37.7	99.8	36.6	97.8	c	
19	5-May	2100	-23	-534	37.9	100.3	36.2	97.1	c	
19	6-May	900	-22	-522	36.9	98.5	26.7	80.0	c	
19	6-May	2100	-22	-510	37.3	99.2	36.2	97.1	c	
19	7-May	900	-21	-498	37.4	99.4	34.6	94.2	c	
19	7-May	2100	-21	-486	36.9	98.5	36.4	97.6	c	
19	8-May	900	-20	-474	37.2	99.0	34.2	93.5	c	
19	8-May	2100	-20	-462	37.1	98.7	36.9	98.5	c	
19	9-May	900	-19	-450	37.4	99.4	36.2	97.1	c	
19	9-May	2100	-19	-438	37.5	99.5	36.2	97.1	c	
19	10-May	900	-18	-426	37.4	99.4	36.6	97.8	c	
19	10-May	2100	-18	-414	37.2	98.9	35.6	96.0	c	
19	11-May	900	-17	-402	37.3	99.1	32.9	91.3	c	
19	11-May	2100	-17	-390	37.4	99.3	35.2	95.3	c	

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
19	12-May	900	-16	-378	37.2	98.9	33.1	91.5	c	
19	12-May	2100	-16	-366	37.8	100.0	36.1	96.9	c	
19	13-May	900	-15	-354	37.4	99.4	35.8	96.4	c	
19	13-May	2100	-15	-342	37.6	99.7	36.1	96.9	c	
19	14-May	900	-14	-330	37.3	99.2	35.6	96.0	c	
19	14-May	2100	-14	-318	36.6	97.8	34.2	93.5	c	
19	15-May	900	-13	-306	37.7	99.8	35.6	96.0	c	
19	15-May	2100	-13	-294	37.4	99.3	36.6	97.8	c	
19	16-May	900	-12	-282	36.9	98.4	35.3	95.5	c	
19	16-May	2100	-12	-270	37.8	100.0	35.3	95.5	c	
19	17-May	900	-11	-258	37.2	98.9	35.2	95.3	c	
19	17-May	2100	-11	-246	37.7	99.9	35.7	96.2	c	
19	18-May	900	-10	-234	37.4	99.4	36.1	96.9	c	
19	18-May	2100	-10	-222	37.8	100.1	36.6	97.8	c	
19	19-May	900	-9	-210	37.4	99.3	36.6	97.8	c	
19	19-May	2100	-9	-198	37.6	99.7	36.6	97.8	c	
19	20-May	900	-8	-186	37.4	99.3	36.9	98.5	c	
19	20-May	2100	-8	-174	37.3	99.1	36.1	96.9	c	
19	21-May	900	-7	-162	37.1	98.8	36.3	97.3	c	
19	21-May	2100	-7	-150	38.2	100.7	37.1	98.7	c	
19	22-May	900	-6	-138	37.3	99.1	36.4	97.6	c	
19	22-May	2100	-6	-126	37.4	99.4	37.1	98.7	c	
19	23-May	900	-5	-114	36.7	98.0	36.6	97.8	c	
19	23-May	2100	-5	-102	37.7	99.8	37.3	99.1	c	
19	24-May	900	-4	-90	37.5	99.5	36.7	98.0	c	
19	24-May	2100	-4	-78	37.3	99.1	37.1	98.7	c	
19	25-May	900	-3	-66	37.2	98.9	37.1	98.7	c	
19	25-May	1200	-3	-63	37.3	99.1	36.9	98.5	c	
19	25-May	1500	-3	-60	37.3	99.1	36.9	98.5	c	
19	25-May	1800	-3	-57	37.8	100.1	37.1	98.7	c	
19	25-May	2100	-3	-54	37.7	99.9	37.2	98.9	c	
19	26-May	900	-2	-42	37.4	99.3	37.1	98.7	c	
19	26-May	2100	-2	-30	37.7	99.9	37.2	98.9	c	
19	27-May	900	-1	-18	37.4	99.3	36.6	97.8	c	
19	27-May	2100	-1	-6	37.6	99.6	36.6	97.8	c	
19	28-May	2400	0	-3	37.4	99.3	37.1	98.7	c	
19	28-May	600	0	3	37.9	100.3	36.9	98.5	c	
19	28-May	900	0	6	37.4	99.4	36.7	98.0	c	
19	29-May	900	1	30	37.6	99.6	37.2	98.9	c	
19	30-May	900	2	54	37.8	100.0	36.7	98.0	c	
19	31-May	900	3	78	37.6	99.6	37.1	98.7	c	
21	16-May	900	-7	-165	37.1	98.8	37.9	100.3	f	
21	16-May	2100	-7	-153	37.4	99.3	37.6	99.6	f	
21	17-May	900	-6	-141	37.1	98.8	37.4	99.4	f	
21	17-May	2100	-6	-129	37.7	99.9	37.6	99.6	f	
21	18-May	900	-5	-117	36.8	98.3	37.3	99.1	f	
21	18-May	2100	-5	-105	37.7	99.8	37.6	99.6	f	
21	19-May	900	-4	-93	37.4	99.3	37.6	99.6	f	
21	19-May	2100	-4	-81	37.2	98.9	37.6	99.6	f	
21	20-May	900	-3	-69	36.7	98.0	37.6	99.6	f	
21	20-May	2100	-3	-57	36.7	98.1	37.9	100.3	f	
21	21-May	900	-2	-45	37.4	99.3	37.7	99.8	f	
21	21-May	2100	-2	-33	37.4	99.3	37.9	100.3	f	
21	22-May	900	-1	-21	36.9	98.5	37.3	99.1	f	
21	22-May	2100	-1	-9	37.4	99.3	37.7	99.8	f	
21	23-May	900	0	3	37.0	98.6	38.2	100.7	f	

APPENDIX 11. CONTINUED

ID	DATE	TIME	DAY	HOURS FROM FOALING	RECTAL (°C)	RECTAL (°F)	SCAN (°C)	SCAN (°F)	SEX	WEIGHT
21	23-May	2100	0	15	37.7	99.8	38.1	100.5	f	
21	24-May	900	1	27	37.3	99.1	38.1	100.5	f	
21	25-May	900	2	51	37.4	99.4	38.1	100.5	f	
21	26-May	900	3	75	37.3	99.1	38.1	100.5	f	
22	16-May	900	-9	-210	36.3	97.4	37.6	99.6	c	
22	16-May	2100	-9	-198	37.2	98.9	37.9	100.3	c	
22	17-May	900	-8	-186	36.8	98.2	37.9	100.3	c	
22	17-May	2100	-8	-174	37.4	99.3	38.1	100.5	c	
22	18-May	900	-7	-162	37.5	99.5	37.9	100.3	c	
22	18-May	2100	-7	-150	38.2	100.7	37.6	99.6	c	
22	19-May	900	-6	-138	36.8	98.2	37.7	99.8	c	
22	19-May	2100	-6	-126	37.2	98.9	38.1	100.5	c	
22	20-May	900	-5	-114	37.3	99.1	37.6	99.6	c	
22	20-May	2100	-5	-102	36.9	98.5	37.7	99.8	c	
22	21-May	900	-4	-90	37.3	99.2	37.4	99.4	c	
22	21-May	2100	-4	-78	37.7	99.8	38.4	101.2	c	
22	22-May	900	-3	-66	36.8	98.3	37.9	100.3	c	
22	22-May	2100	-3	-54	37.6	99.7	38.1	100.5	c	
22	23-May	900	-2	-42	37.3	99.2	37.6	99.6	c	
22	23-May	2100	-2	-30	37.6	99.7	38.1	100.5	c	
22	24-May	900	-1	-18	36.3	97.3	37.6	99.6	c	
22	24-May	2100	-1	-6	37.7	99.8	38.1	100.5	c	
22	25-May	2400	0	-3	37.4	99.3	38.1	100.5	c	
22	25-May	300	0	0	37.1	98.8	37.1	98.8	c	
22	25-May	600	0	3	37.8	100.0	37.6	99.6	c	
22	25-May	900	0	6	37.4	99.3	38.4	101.2	c	
22	26-May	900	1	30	37.7	99.9	38.3	100.9	c	
22	27-May	900	2	54	37.3	99.1	38.1	100.5	c	
22	28-May	900	3	78	37.0	98.6	38.2	100.7	c	
23	18-May	900	-11	-261	37.5	99.5	38.1	100.5	f	
23	18-May	2100	-11	-249	37.8	100.0	37.6	99.6	f	
23	19-May	900	-10	-237	37.3	99.1	37.7	99.8	f	
23	19-May	2100	-10	-225	37.6	99.6	37.6	99.6	f	
23	20-May	900	-9	-213	36.9	98.5	37.7	99.8	f	
23	20-May	2100	-9	-201	37.6	99.7	37.7	99.8	f	
23	21-May	900	-8	-189	37.1	98.7	38.1	100.5	f	
23	21-May	2100	-8	-177	37.8	100.1	38.4	101.2	f	
23	22-May	900	-7	-165	37.3	99.1	38.3	100.9	f	
23	22-May	2100	-7	-153	37.8	100.1	38.2	100.7	f	
23	23-May	900	-6	-141	37.7	99.8	38.6	101.4	f	
23	23-May	2100	-6	-129	36.9	98.5	38.9	102.1	f	
23	24-May	900	-5	-117	37.4	99.3	38.6	101.4	f	
23	24-May	2100	-5	-105	37.6	99.6	38.0	100.4	f	
23	25-May	900	-4	-93	37.7	99.9	38.2	100.7	f	
23	25-May	2100	-4	-81	37.7	99.8	38.1	100.5	f	
23	26-May	900	-3	-69	37.9	100.2	39.4	103.0	f	
23	26-May	2100	-3	-57	37.4	99.4	37.7	99.8	f	
23	27-May	900	-2	-45	37.9	100.2	38.3	100.9	f	
23	27-May	2100	-2	-33	37.0	98.6	35.6	96.1	f	
23	28-May	600	-1	-24	37.0	98.6	37.4	99.4	f	
23	28-May	900	-1	-21	37.0	98.6	37.6	99.6	f	
23	28-May	2100	-1	-9	37.2	98.9	37.7	99.8	f	
23	29-May	900	0	3	36.8	98.2	37.4	99.4	f	
23	30-May	900	1	27	37.5	99.5	37.9	100.3	f	
23	31-May	900	2	51	37.8	100.1	38.4	101.2	f	

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